THE

# ELECTRICAL REVIEW.

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## CONTENTS:

| | PAGE |
|---|---|
| The Lang Case | 261 |
| The Telephone Question | 263 |
| Dangers of Electric Light Work | 263 |
| The Chicago International Electrical Congress | 265 |
| Sound and Vibration | 269 |
| A Brief History of the Incandescent Lamp Litigation | 269 |
| The Goebel Defence (*illustrated*) | 269 |
| Ealing Electric Lighting | 270 |
| Woodhouse and Rawson | 272 |
| Legal: Lang *v.* The House-to-House Electric Lighting Co. | 272 |
| Tienhoven and Bevan *v.* Appleton & Co. | 274 |
| Bowes, Scott & Western *v.* Caustic Soda and Chlorine Syndicate | 274 |
| Alabaster and Others *v.* The Medical Battery Company | 275 |
| Notes | 286 |
| Contracts Open and Closed | 289 |
| Business Notices, &c. | 289 |
| City Notes, &c.:—Woodhouse and Rawson United | 290 |
| House-to-House Electric Light Supply Company | 292 |
| South Staffordshire Tramways Company | 293 |
| Traffic Receipts | 293 |
| Share List of Electrical Companies | 294 |
| Electric Furnace for Laboratories (*illustrated*) | 295 |
| Free Wiring | 295 |
| The E.M.F. of the Post Office Standard Cell | 296 |
| Treatment of Expenses of Installing Electric Works | 296 |
| Some Experiments with Disruptive Discharges (*illustrated*) | 297 |
| Review:—Polyphased Alternating Currents | 298 |
| The Electric Lighting of Belfast | 299 |
| New Patents | 299 |
| Abstracts of Published Specifications | 300 |
| Correspondence:—Ozone in Agriculture | 300 |

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## THE LANG CASE.

IT is not often that a County Court decision possesses the importance which attaches to the finding given at Brompton on the 2nd inst., in the matter of Lang *v.* The House-to-House Electric Lighting Company, Limited. The case was one above the ordinary run of actions heard in that Court, and the issues involved were of considerable importance to those interested in the electrical industry. In addition to this, the sum claimed was a fairly large one, and the technical points which were necessarily dealt with, brought expert witnesses into Court, whose evidence, or that portion of it relevant to the case, had to do with the precautions usually observed in working a converter system. It will be remembered that we referred to this matter when the accident occurred which has led to the recent action. We then had but the facts elicited by the coroner's inquest and the newspaper reports before us, and assuming, as was fair to do, that these represented the truth in connection with the unfortunate occurrence, we somewhat severely reflected upon the company's action and methods, believing, from statements given in evidence, that an unskilled man had been given work to do which, even in trained hands, is not without grave risk, and which, under the circumstances, could hardly be too severely criticised. Although names were mentioned, and the premises dwelt upon, the company allowed the reference to them and their position to pass without challenge, or attempt at correction, and it would therefore not be unreasonable to assume that no reply could be given save a silence which was ominous. Since the publication of the article nothing transpired up to the opening of the case in the Brompton County Court. It was then that some additional light was brought to bear upon the subject and the position of the House-to-House Company made clear. It may be well to recall the facts as they were known to the public at the time of the beginning of the trial. On the 9th of November, 1892, the House-to-House Electric Light Supply Company, Limited, who supply the West Brompton and West Kensington districts, were laying a service into a house in Roland Gardens, Kensington. Two men were engaged upon this work, one Young, a jointer, and Lang, presumably a labourer. The supply at Brompton is given on the Lowrie-Hall system with house converters, the mains and service wires consisting of vulcanised rubber cables drawn into cast-iron pipes and having a difference of potential between the two conductors of 2,000 volts. During the forenoon the current was off the mains upon which the men were working, but sometime in the afternoon the supply was switched on, as far as could be ascertained, without the knowledge of the workmen still employed in the Roland Gardens service. Shortly after 4 o'clock, Lang, under orders from the jointer, Young, took hold of the cable, was seen to fall, and shortly afterwards expired. How, why, or by whose negligence was not known, but the inevit-

able stirring up of the danger bogey in connection with electric lighting followed. From the meagre details forthcoming, it appeared that the company had provided or professed to have provided India-rubber gloves for the use of their linesmen, and reliance was placed upon the protection thus afforded to avoid personal harm to the *employés* when working on or with live cables. Formerly the mains were not connected with one another in any way. The standard switch gear at the station permitted of running either parallel on buss bars, two or more mains on a single machine or each machine on its own circuit. When, however, the management came into Mr. Albert Gay's hands, extensions and improvements may have been adopted, and it was not known how far the knowledge of the older system of working applied to that in vogue at the time of the accident in Roland Gardens. The staff and *employés* together with the management of the company desired to assist those whose position by the loss of the bread winner was a most unhappy one, and some £50 was collected and offered to the widow on the understanding that by the acceptance of this aid she agreed to forego any legal remedy she might have by right against the company. Such a sum was a poor value to set against a man's life, and looking at the case it was one which formed a righteous claim upon those by whose neglect a wife and her two children had been left to suffer the lot of the unprotected in a hard world. Naturally enough one story held until the other was told, and a suit was entered under Lord Campbell's Act against the Company for damages set at £300, although it was known that under the provisions of the Act the maximum for which judgment could be given was £180. The learned judge agreed that ten years' allowance at the rate of 10s. a week would be a fair claim to allow, were the verdict in favour of the plaintiff, and the question at issue was narrowed down to the liability of the company to pay damages at all. Had there been negligence on the part of the company in its method of working or in its appliances and plant? Had the deceased man, by his personal negligence, contributed to the accident? The protection afforded by gloves, and such like precautions, always adopted by skilled experimenters when handling high-tension conductors, assumed an importance which had not previously been expected. So long as the plaintiff's witnesses were in the box, little that was novel was elicited. The experts called had, as usual, slight differences of opinion as to the efficacy of these means of reducing risk, and went outside the question by attacking the system of mains and the class of cable used. On this little doubt exists. A pair of non-concentric vulcanised rubber cables drawn into cast-iron pipes, provided the cables are from the works of a reputable manufacturer, forms probably the best and safest method of laying conductors for high tension underground. In the hands of an engineer of experience, such as Mr. Gay unquestionably is, there should be no reason for doubting the perfectness of such a system, nor has any evidence been adduced to cause us to criticise the works of the company. What we did call into question was the manner of conducting the necessary operations incidental to supply. Now what has been ascertained as to this? From the defendants' case it is learnt that the man Lang was in receipt of wages at the rate of 25s. per week. He was rated an, and performed the duties of assistant jointer, having been trained in such work, and employed in making joints when necessary. Owing to the increase in the number of consumers it is no longer possible to block or shut down a main entirely, so the engineer of the company has designed, and there are in operation what we believe to be a novelty, high tension joints or "Bowden couplers." These enable sections of the mains to be freed when necessary, without stopping the supply to more than the 80 premises mentioned in the Board of Trade regulations. When jointing, the custom is to disconnect two of the couplers, using gloves for the purpose, so freeing the section in which the joint is to be made. On completion of the joint the gloves are again used to reconnect the couplers, and supply is resumed. The whole operation is thus performed without the intervention of the switch gear at the central station. There seems to be little doubt that Lang had been warned of the danger attending handling of cables under pressure, and that for the cases when this was necessary he was provided with suitable gloves, which were tested and found to be in good order by Taylor, the electrician in charge of the mains. With the usual temerity of his class, however, Lang neglected to use the gloves in the one case where a flaw existed in the insulation of the cable he was handling, and his life paid the penalty. Whatever may be the wisdom of requiring men of this class to do work necessitating the use of insulating gloves, it is not reasonable to doubt that in this instance had the instructions of the company's officers been followed, there would have been no accident. The evidence contains the striking passage that immediately before proceeding to pull the cable up taut, Lang himself assisted the electrician to connect up the couplers, showing that he must have been aware of the pressure on the cable. The verdict is strict justice, and with the evidence to point to it we have no fault to find, but yet cannot help feeling for the widow and little ones in their bereavement. Perhaps the only pity is that the company should have been left with a branding of negligence. A jury, however honest, cannot fully appreciate the niceties of central station working, and had they confined their verdict to judgment for the defendants, still greater fairness would have been shown. The lessons to be learnt from this case are badly needed, and may tend to save us from casualties of a like nature. Too great dependence upon the results of electric testing instruments, which at best are only of use to those whose experience enables them to read the cause of that which they show the effect; the idea that give an "instruction," and leave the rest to Providence, is an honest, even if legal, mode of dealing with men, and the forgetfulness that the potentialities of a high pressure current are ever ready to make themselves felt, given but a moment's want of responsible supervision, are the factors which when taken together bring Lang cases into our Courts, and warning cries into our newspaper columns.

It is not too much to say that rubber gloves rank with our present system of fuses, necessary evils to be borne until such time as progress displaces them by something better and a little less barbarous in conception. According to the finding of the jury, the House-to-House Company have not come out of the Lang case with credit, but they seem to have shown that in all the pressure of a rapidly-growing business they have cared for their *employés*, should the latter but care for themselves. How far it is prudent to leave them to care for themselves, permissibly only, is a question we leave others to answer.

## THE TELEPHONE QUESTION.

ANOTHER article on this subject becomes necessary by reason of further comments by our contemporaries on our last article.

The *Electrical Engineer* continues to discuss the matter seriously and sensibly, and we refer to their article later. *Lightning*, we are sorry to see, attempts to discover an inconsistency in our views at different dates; but the attempt is obviously unsuccessful. *Lightning* does not yet see that it is possible to convey inaccurate impressions by accurate information. It tells us that there are seven or eight exchanges in Glasgow, and not one as we supposed. This information may be accurate, but evenso the impression conveyed is inaccurate. Unless changes have been recently made, there is one exchange in which the bulk of the subscribers are centred, but, as will always happen, there are certain parts or outlying districts in which small exchanges are situated. If *Lightning* would only take the trouble to read our articles it would understand the difference.

The *Electrical Engineer* very properly desires to have a definition of terms before it can recognise that the argument is being carried on upon the same platform. The necessity for this definition arises from our substitution of "Law" for "Mann" in our last article. Our contemporary says we assume *Mann* to be the equivalent of *Law*, an assumption which it courteously but emphatically denies. Our contemporary adds that if the systems are the same their case is gone; if they are not the same our own criticism is beside the mark.

There is some satisfaction in a controversy in which facts are sought on both sides, and a reasonable interpretation is placed upon them when they are found. Until the Mann system was brought into prominence at the British Association, it was supposed that there was some difference between it and the Law.

In commenting upon the discussion in our columns, we wrote, on November 13th, 1891 (page 558), as follows:—"We described [in an earlier article] the Mann system as being one by which the subscribers notify their call to the operator by word of month instead of by visual signal. We said the system was better known as the Law system, and we described 'the difference between the Law circuit wire as originally used, and that known as the Mann circuit wire,' the first being 'a continuous line,' and the second 'a main line with branches.' It was as a circuit wire system, without regard to the nature of the circuit wire, that we considered the proposals made, and had the discussion been continued on the same lines, very much time and space would have been saved, and many misunderstandings prevented, though the advocates of the Mann system might perhaps have still remained under the impression that the Mann system and the Law system differed in something more than name." We produced evidence of the use of branched wires in 1880, and we wrote that as this evidence referred to "systems in general use in 1880, and Mr. Mann says his system was invented in the spring of 1882, there would seem to be no need to continue any discussion on the question whether the Mann call wire was or was not in use before it was invented by Mr. Mann."

If our contemporary will refer to our article of that date, we think it will be satisfied that the evidence of identity is complete, and that the argument based on any difference, actual or supposed, does not hold water. Our contemporary may be assured that the invention of a branched call wire is due to the electricians of the Law Company of New York, and was used there and elsewhere, certainly in 1880, and, probably, in 1879; and we are sure it will agree with us that it would be improper to continue to speak of a system under one name when it was previously and properly known under another.

We fully agree with our contemporary that broad questions are the suitable subjects for discussion, and the two which it suggests are undoubtedly important, but the method of providing inter-communication is of first importance in a telephone exchange system. The use of underground conductors itself leads to the necessity of metallic returns. Interferences arising from causes outside the telephone system lead in the same direction, but, regarded from the point of view of telephonic conversation alone, there are no advantages in an underground system. We should expect that anyone proposing to construct anew a telephone system would not omit to take advantage of the drift of experience, and experience tends to show the necessity of metallic returns. And for London there is no doubt whatever that more or less of underground work should be provided for also.

When our contemporary suggests we might also admit that the National Telephone Company would have waited for the millennium before approaching the consideration of these questions had there been no signs of opposition, we cannot refrain from asking what is the good of "signs" of opposition, and what is the present net result of those signs? An opposition was started which was to combine wonderful advantages of systems with public benefit and 10 per cent. We pointed out that the easiest way of making money would be taken, and it has been taken. We see no reason to assume that any public benefit will result from such signs of opposition, and we may frankly say that we would rather the National Company deferred indefinitely the consideration of some of the practical questions referred to than act spasmodically on ill-considered proposals as they were urged to do by the *Standard*.

## DANGERS OF ELECTRIC LIGHT WORK.

IT has been said that "experience teaches fools." This has been adapted to the needs of our *fin de siècle* age by the rendering, "Not fools, but wise men learn by experience, for the former profit not by her teaching." The high fees which Dame Experience has been credited with charging for the lessons she teaches become a burden unbearable when human life is the coin in which they are paid. It is doubly unfortunate for the industry when electric lighting is credited with victims, for the general distrust which has been slowly and by great effort undermined and uprooted, will spring into being at once on alarmist paragraphs appearing in the daily press. Not only this, but as high tension, or as they are coming to be known by the more logical term, "Converter," systems, are responsible for such fatalities as occur, the general progress of the industry must suffer re-

tardation, considering that the suitable districts for direct supply have been almost wholly taken up, and that the "doubtful" ones can only be efficiently dealt with by a converted supply. It seems as if a series of victims to the want of supervision in existing high tension stations will alone bring home responsibility to the minds of those who comprise the staff on such companies. We have had sufficient acquaintance with existing practice to know how prone men are to grow careless of an ever-present danger, and the risk that in an excess of zeal they may be tempted to overstep the limits of prudential action in the discharge of their duties, but we do think that too much reliance has been, and is being, placed upon instructions and regulations given to men of the labouring class, to whom the potentialities of high pressure currents are unknown. It seems that supervision, such as exists in places like corporation waterworks and marine engine rooms, akin in their nature to central stations, is a thing of the future. The operations of the Factory Acts, coupled with the ever present dread of that personage, the factory inspector, have done much to remove such risk as is removable from the operatives in our factories and industrial works. The same should be considered to hold in central stations, where unskilled men of the artisan class are employed. The Brush Company were among the first to recognise this, and their type of alternator and switchboard meet the point fairly well. The Lowrie-Hall pattern of machine and switchroom appear, from theoretical considerations, to be equally perfect; but how often does one bring to mind the somewhat cynical, and anything but consoling, reflection that if there are two ways of doing a thing, someone is sure, at some time or other, to take the wrong way of doing it; aye, and against any amount of telling, of cautioning, and of advice. It is, therefore, next to imperative that means should be taken to exercise a paternal regard for those who seem at times to be utterly regardless of their own welfare, and to render the results of such carelessness innocuous, if the prevention is beyond our present powers. It is not too late to protest vigorously against the employment of labourers about switch gear, or in any portion of station or network where a large difference of potential exists between two conductors, or can, under any circumstances, be caused to exist between any exposed or imperfectly protected metal work and earth.

The scientific student and laboratory engineer looks upon rubber gloves, and such like protections, as an impregnable line of defence against such a combination of circumstances as would probably set a good example to the Yankees of how to electrocute without a bungle. This is so, no doubt, in the hands of those with whom gloves of kid are every-day affairs, for the assumption that the hands so encased are controlled by brains is not an unreasonable one. It is quite another thing to offer a workman, artisan, or labourer such protection—protection as delusive in this case as efficient in the other. Take into consideration for a moment the circumstances under which a workman carries out his duties, and the likelihood of rubber gloves being anything but a dielectric after a day or two of use, and unless a company desires to pay its profits over to a *Maison de Gants*, it would do well to keep such accessories for those able to appreciate them. On the other hand, the technical staff of a supply company should be men fearless, competent, and willing to do all in their power to ensure success. If there is dangerous work waiting to be done, and done it must be, rather let those to whom the credit will fall, whose salaries are rewards for superior capabilities, and whose knowledge a safeguard, volunteer for the job, and the electric industry will be worthy of her sons. Again, trained electrical men are almost a drug on the market; in numbers plentiful, and to be had for but little more than the lower class labour so much in vogue. Such men can be trusted to avoid the dangers which necessarily must exist, and the financial result need not be discouraging.

The latest of the victims to carelessness seems to have erred against light and knowledge, but none the less do we regret that a "Terrible Death at Brighton—Another fatality at the Electric Light Works" should startle the timid public into the belief that the old dictum that alternating supply was a wild beast to be kept caged and watched from a distance, lest the public should suffer for their temerity, still, and maybe for ever, will remain true. We cannot admit that there are any dangers to be feared, which, by the display of a little common sense could not be reduced to the level of those contingent to manufacturing operations generally. Human life at the present day has an absurdly high value attached to it in the opinion of those to whom dangers, difficulties, and privations have been but incidents of daily life, and, looking backward at the history of nations, there is something to be said for such a view; nevertheless, in an industry in the sphere of modern life, one which itself is an aid to luxury, the less we hear of fatalities, accidents, and the attendant lawsuits, the better for those engaged therein. The public are prone to overlook the difference between an unfortunate occurrence which takes place in the Supply Company's domain, and what may or could happen to one of themselves who utilised the supply so afforded.

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Boston and Chicago Long-Distance Telephone Line.

On February 7th, the Boston and Chicago line was formally opened. The line extends from Boston, across Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and Indiana to Chicago. Providence and New York are among the points which the line touches. The line is about 1,200 miles long, with an average of 45 poles to the mile, making a total of 54,000 poles. No. 8 hard-drawn copper wire is used, weighing 435 lbs. per mile, which makes a total of about 1,044,000 lbs. used in its construction. The usual weight of such a line would be only about 413,000.

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Measurement of Iron Losses.

Mr. Moore describes in the New York *Electrical World* an ingenious method of measuring the iron losses in long rods. The method is a combination of one of the well known methods of obtaining the E.M.F. and current curves of alternators with a magneto-meter. The magnetising current is provided by an alternator at the proper periodicity, but the magneto-meter consists of a small coil through which instantaneous currents can be sent at any point of the current curve by means of one of the usual commutators employed in these methods. The deflection is then proportional to the magnetism existing at that point of the cycle. The author finally proposes to use this method to get photographic records of hysteresis curves. For this purpose he employs a modification of the magneto-meter proposed for a similar purpose by Mr. G. F. C. Searle, using coils instead of magnets to cause the deflections in azimuth and altitude.

## THE CHICAGO INTERNATIONAL ELECTRICAL CONGRESS.

THE following particulars are published by the American Institute of Electrical Engineers as a supplement to the report of the sub-committee on Provisional Programme for the International Electrical Congress of 1893, which appeared in our issue for February 3rd, 1893, page 121.

### APPENDIX I.

*Brief summary of the units, terms, symbols, and definitions, adopted by previous electrical congresses.*

The Paris Congress of 1881 adopted, on September 21st, 1881, the following:

The fundamental units:—centimetre, mass of a gramme and the second, for electrical measurements. The practical units, ohm and volt, defined in terms of the absolute units. The ampère defined by the volt and the ohm. The coulomb defined by the ampère and the second. The farad defined by the coulomb and the volt. It also resolved that the ohm be represented by a column of mercury of one square millimetre cross-section at 0° C., and of such a length, to be determined by an international commission, that its resistance be equal to the ohm.

The Paris Conference of 1884 adopted, on May 3rd, 1884, the following:

The legal ohm of 106 centimetres. The ampère defined in terms of the absolute units. The volt defined by this ampère and the legal ohm. The unit of light defined as the quantity of light emitted perpendicularly from a square centimetre of platinum at the temperature of its solidification.*

At the Philadelphia Conference, in 1884, it was proposed to adopt the "watt," but, from the official records, this term does not appear to have been formally adopted.

The Paris Congress of 1889 adopted, on August 31st, 1889, the following:

The joule defined in terms of the absolute units, and in terms of the ampère, ohm, and second. The watt in terms of the absolute units, and also in terms of the joule and second. The bougie-decimale† defined as the twentieth part of the absolute standard of light adopted by the Conference of 1884. The quadrant as the practical unit of induction defined in centimetres. This congress also defined the following terms:—The period of an alternating current is the duration of one complete oscillation. The frequency is the number of periods per second. The mean intensity of an alternating current is defined by the relation:

$$C_{mean} = \frac{C}{T}\int_0^T c\,dt.$$

The effective intensity is the square root of the mean square of the intensity of the current. The effective E.M.F. is the square root of the mean square of the E.M.F. The apparent resistance is the factor by which the effective intensity must be multiplied to give the effective E.M.F. The positive pole of an accumulator is the one which is connected to the positive pole of a dynamo during the charge, and is the positive pole during the discharge. The term interurban is to apply to all telephonic communication between two subscribers or public stations belonging to different groups. The metallic circuit was adopted for urban telephone circuits and for interurban lines.

The Frankfort Congress of 1891 adopted, on September 12th, 1891, the following:—

Physical quantities shall be represented in italics. Units shall be represented in Roman type. Physical constants and angles shall be represented by Greek letters. The practical electrical units shall be represented by their initial letters in Roman capitals as follows:—Ampère by A, coulomb by C, farad by F, volt by V, joule by J, ohm by O, watt by W.

The proposition made by Mr. Hospitalier,‡ to establish an international system of notation, abbreviations and symbols, was referred to a committee, to report at the next congress.

* The name "violle," sometimes applied to this standard of light, was not adopted by this conference, but came into use subsequently. It does not appear to have been formally adopted by any international congress. This standard is equal to about 2·08 carcels, or, approximately, to 20 English candles.

† The bougie-decimale is a close approximation to the English standard candle, as also to $\frac{1}{10}$th part of a carcel.

‡ See Appendix IV.

### APPENDIX II.

The following is taken from the Report of the Committee of the American Institute of Electrical Engineers, on "Units and Standards":—

LIST OF NEW UNITS PRACTICALLY NEEDED FOR CONVENIENCE IN DEALING WITH MAGNETIC CIRCUITS.

*1st.—Magneto-Motive Force, and Difference of Magnetic Potential.*

Simple Definition.—The analogue in a magnetic circuit of voltage in an electric circuit.

Strict Definition.—The magneto-motive force in a magnetic circuit is $4\pi$ multiplied by the flow of current linked with that circuit.

The magneto-motive force between two points connected by a line is the line integral of magnetic force along that line.

Electro-magnetic dimensional formula, $L^{\frac{1}{2}}\,M^{\frac{1}{2}}\,T^{-1}$.

The absolute unit of M.M.F. is $\frac{1}{4\pi}\times$ unit current of one turn.

The practical unit is $\frac{1}{4\pi}\times$ ampère of one turn, or one-tenth of the absolute unit—*i.e.*, 0·0796 ampère-turn gives the unit.

The prefix kilo would perhaps be occasionally used for practical applications.

*2nd.—Magnetic Flux.*

Simple Definition.—Total number of lines of force or total field.

Strict definition.—The magnetic flux through a surface bounded by a closed curve is the surface integral of magnetic induction taken over the bounded surface, and when produced by a current is also equal to the line integral of the vector potential of the current taken round the boundary.

The uniform and unit time rate of change in flux through a closed magnetic circuit establishes unit electromotive force in the circuit.

Electro-magnetic dimensional formula, $L^{\frac{3}{2}}\,M^{\frac{1}{2}}\,T^{-1}$.

The absolute unit is one C.G.S. line of induction.

The practical unit is $10^8$ C.G.S. lines.

Fluxes range in present practical work from 100 to 100,000,000 C.G.S. lines, and the working units would perhaps prefix milli- and micro-.

*3rd.—Magnetic Intensity or Induction Density.*

Simple Definition.—Flux per sq. cm.

Strict Definition.—The induction density at a point within an element of surface is the surface differential of the flux at that point.

Electro-magnetic dimensional formula, $L^{-\frac{1}{2}}\,M^{\frac{1}{2}}\,T^{-1}$.

Absolute unit, one C.G.S. line per sq. centimetre.

Practical unit, $10^8$ C.G.S. lines per sq. cm.

In practice, excluding the earth's field, intensities range from 100 to 20,000 lines per sq. cm., and the working unit would perhaps have the prefix milli- or micro-.

*4th.—Magnetic Reluctance.*

Definition.—Unit reluctance in a magnetic circuit permits unit magnetic flux to traverse it under the action of unit magneto-motive force.

Dimensional formula, $L^{-1}\,M^{0}\,T^{0}$.

The practical unit is $10^{-9}$ the absolute unit.

Reluctances vary in present practical work from 100,000 to 100,000,000 of these practical units, so that the working unit would perhaps employ the prefix mega-.

A. E. KENNELLY, *Chairman.*
FRANCIS B. CROCKER,
WM. E. GEYER,
GEO. A. HAMILTON,
GEO. B. PRESCOTT, Jun.

## APPENDIX III.

The following specifications are those contained in the recent report of the British Board of Trade Committee on Electrical Standards :—

### The Silver Voltameter.

In the following specification, the term silver voltameter means the arrangement of apparatus by means of which an electric current is passed through a solution of nitrate of silver in water. The silver voltameter measures the total electrical quantity which has passed during the time of the experiment, and by noting this time, the time-average of the current, or if the current has been kept constant, the current itself can be deduced.

In employing the silver voltameter to measure currents of about 1 ampère, the following arrangements should be adopted :—The cathode on which the silver is to be deposited should take the form of a platinum bowl, not less than 10 cm. in diameter, and from 4 cm. to 5 cm. in depth. The anode should be a plate of pure silver, some 30 square cm. in area, and two or three millimetres in thickness. This is supported horizontally in the liquid near the top of the solution, by a platinum wire passed through holes in the plate at opposite corners. To prevent the disintegrated silver which is formed on the anode from falling onto the cathode, the anode should be wrapped around with pure filter paper, secured at the back with sealing wax. The liquid should consist of a neutral solution of pure silver nitrate, containing about 15 parts, by weight of the nitrate, to 85 parts of water. The resistance of the voltameter changes somewhat as the current passes. To prevent these changes having too great an effect on the current, some resistance besides that of the voltameter should be inserted in the circuit. The total metallic resistance of the circuit should not be less than 10 ohms.

*Method of Making Measurement.*—The platinum bowl is washed with nitric acid and distilled water, dried by heat, and then left to cool in a desiccator. When thoroughly dry, it is weighed carefully. It is nearly filled with the solution, and connected to the rest of the circuit by being placed on a clean copper support, to which a binding screw is attached. This copper support must be insulated. The anode is then immersed in the solution, so as to be well covered by it, and supported in that position; the connections to the rest of the circuit are made. Contact is made at the key, noting the time of contact. The current is allowed to pass for not less than half an hour, and the time at which contact is broken is observed. Care must be taken that the clock used is keeping correct time during this interval. The solution is now removed from the bowl, and the deposit is washed with distilled water, and left to soak for at least six hours. It is then rinsed successively with distilled water and absolute alcohol, and dried in a hot air bath, at a temperature of about 160° C. After cooling in a desiccator, it is weighed again. The gain in weight gives the silver deposited.

To find the current in ampères, this weight, expressed in grammes, must be divided by the number of seconds during which the current has been passed, and by ·001118. The result will be the time-average of the current, if, during the interval, the current has varied.

In determining by this method the constant of an instrument, the current should be kept as nearly constant as possible, and the readings of the instrument taken at frequent observed intervals of time. These observations give a curve, from which the reading corresponding to the main current—time-average of the current—can be found. The current, as calculated by the voltameter, corresponds to this reading.

### The Clark Cell.

*Definition of the Cell.*—The cell consists of zinc and mercury in a saturated solution of zinc sulphate and mercurous sulphate in water, prepared with mercurous sulphate in excess, and is conveniently contained in a cylindrical glass vessel.

*Preparation of the Materials:*

1. *The Mercury.*—To secure purity, it should be first treated with acid in the usual manner, and subsequently distilled in vacuo.

2. *The Zinc.*—Take a portion of a rod of pure redistilled zinc, solder to one end a piece of copper wire, clean the whole with glass paper, carefully removing any loose pieces of the zinc. Just before making up the cell, dip the zinc into dilute sulphuric acid, wash with distilled water, and dry with a clean cloth or filter paper.

3. *The Zinc Sulphate Solution.*—Prepare a saturated solution of pure ("pure recrystallised") zinc sulphate, by mixing in a flask distilled water, with nearly twice its weight of crystals of pure zinc sulphate, and adding zinc oxide in the proportion of about 2 per cent. by weight of the zinc sulphate crystals to neutralise any free acid. (See notes below.) The crystals should be dissolved with the aid of gentle heat, but the temperature to which the solution is raised should not exceed 30° C. Mercurous sulphate, treated as described in paragraph 4, should be added in the proportion of about 12 per cent. by weight of the zinc sulphate crystals, and the solution filtered, while still warm, into a stock bottle. Crystals should form as it cools.

4. *The Mercurous Sulphate.*— Take mercurous sulphate, purchased as pure, and wash it thoroughly with cold distilled water, by agitation in a bottle; drain off the water, and repeat the process at least twice. (See notes below.) After the last washing, drain off as much of the water as possible. Mix the washed mercurous sulphate with the zinc sulphate solution, adding sufficient crystals of zinc sulphate from the stock bottle to ensure saturation, and a small quantity of pure mercury. Shake these up well together to form a paste of the consistence of cream. Heat the paste, but not above a temperature of 30° C. Keep the paste for an hour at this temperature, agitating it from time to time, then allow it to cool; continue to shake it occasionally while it is cooling. Crystals of zinc sulphate should then be distinctly visible, and should be distributed throughout the mass; if this is not the case, add more crystals from the stock bottle, and repeat the whole process. This method ensures the formation of a saturated solution of zinc and mercurous sulphates in water. Contact is made with the mercury by means of a platinum wire about No. 22 gauge. This is protected from contact with the other materials of the cell by being sealed into a glass tube. The ends of the wire project from the ends of the tube: one end forms the terminal, the other end and a portion of the glass tube dip into the mercury.

*To Set Up the Cell.*—The cell may conveniently be set up in a small test tube of about 2 cm. diameter, and 6 cm. or 7 cm. deep. Place the mercury in the bottom of this tube, filling it to a depth of, say, 1·5 cm. Cut a cork about ·5 cm. thick to fit the tube; at one side of the cork bore a hole, through which the zinc rod can pass tightly; at the other side bore another hole for the glass tube which covers the platinum wire; at the edge of the cork cut a nick through which the air can pass when the cork is pushed into the tube. Wash the cork thoroughly with warm water, and leave it to soak in water some hours before use. Pass the zinc rod about 1 cm. through the cork.

Clean the glass tube and platinum wire carefully, then heat the exposed end of the platinum red hot, and insert it in the mercury in the test tube, taking care that the whole of the exposed platinum is covered. Shake up the paste, and introduce it without contact with the upper part of the walls of the test tube, filling the tube above the mercury to a depth of rather more than 2 cm. Then insert the cork and zinc rod, passing the glass tube through the hole prepared for it. Push the cork gently down, until its lower surface is nearly in contact with the liquid. The air will thus be nearly all expelled, and the cell should be left in this condition for at least 24 hours before sealing, which should be done as follows :—Melt some marine glue until it is fluid enough to pour by its own weight, and pour it into the test tube above the cork, using sufficient to cover completely the zinc and soldering. The glass tube should project above the top of the marine glue.

The cell thus set up may be mounted in any desirable manner. It is convenient to arrange the mounting so that the cell may be immersed in a water bath up to the level of, say, the upper surface of the cork. Its temperature can then be determined more accurately than is possible when the cell is in air. In using the cell, sudden variations of temperature should, as far as possible, be avoided.

### Notes.

*The Zinc Sulphate Solution.*—The object to be attained is the preparation of a neutral solution of pure zinc sulphate

saturated with $ZnSO_4$ 7 $H_2O$. At temperatures above 30° C., the zinc sulphate may crystallise out in another form; to avoid this, 30° C. should be the upper limit of temperature. At this temperature, water will dissolve about 1·9 times its weight of the crystals. If any of the crystals put in remain undissolved, they will be removed by the filtration. The amount of zinc oxide required depends on the acidity of the solution, but 2 per cent. will, in all cases which will arise in practice with reasonably good zinc sulphate, be ample. Another rule would be to add the zinc oxide gradually, until the solution became slightly milky. The solution, when put into the cell, should not contain any free zinc oxide; if it does then, when mixed with the mercurous sulphate, zinc sulphate and mercurous oxide are formed; the latter may be deposited on the zinc and affect the E.M.F. of the cell. The difficulty is avoided by adding, as described, about 12 per cent. of mercurous sulphate before filtration; this is more than sufficient to combine with the whole of the zinc oxide originally put in, if it all remains free; the mercurous oxide formed, together with any undissolved mercurous sulphate, is removed by the filtration.

*The Mercurous Sulphate.*—The treatment of the mercurous sulphate has for its object the removal of any mercuric sulphate which is often present as an impurity. Mercuric sulphate decomposes in the presence of water into an acid and a basic sulphate. The latter is a yellow substance—turpeth mineral—practically insoluble in water; its presence, at any rate in moderate quantities, has no effect on the cell. If, however, it is formed, the acid sulphate is formed also. This is soluble in water, and the acid produced affects the E.M.F. The object of the washings is to dissolve and remove this acid sulphate, and for this purpose the three washings described in the specification will, in nearly all cases, suffice. If, however, a great deal of the turpeth mineral is formed, it shows that there is a great deal of the acid sulphate present, and it will then be wiser to obtain a fresh sample of mercurous sulphate, rather than try by repeated washings to get rid of all the acid. The free mercury helps in the process of removing the acid, for the acid mercuric sulphate attacks it, forming mercurous sulphate and acid, which is washed away. The cell may be sealed in a more permanent manner by coating the marine glue, when it is set, with a solution of sodium silicate, and leaving it to harden.

## APPENDIX V.

The following is taken from the report of the Committee of the American Institute of Electrical Engineers.

### MATTHIESSEN'S STANDARD OF RESISTANCE OF COPPER.

*Report of the Standard Wiring Table Committee.—Revised by the Committee on Units and Standards.*

The Council of the American Institute of Electrical Engineers, at its regular monthly meeting held December 3rd, 1889, appointed a committee "To formulate and submit for approval a Standard Wiring Table for lighting and power purposes."

The committee appointed consisted of the following members of the Institute:—Thomas P. Conant, Dr. Louis Duncan, Prof. Wm. E. Geyer, A. E. Kennelly, Geo. B. Prescott, jun., E. Wilbur Rice, jun., Prof. E. P. Roberts, Prof. Harris J. Ryan, William Stanley, jun., Dr. Schuyler S. Wheeler, and Francis B. Crocker, chairman.

This action was taken by the Council with the object of overcoming or reducing the great confusion which now exists in regard to the standards and constants of electrical conductors.

At the first meeting of the committee, held January 10th, 1890, it was decided to confine the work for the present to the three subjects of "Standard of Resistance," "Temperature Co-efficient," and "Safe Carrying Capacity of Copper," since these are of fundamental importance.

The subject of "Matthiessen's Standard" alone is so confused and involved, and the discrepancies in regard to it are so great between the best authorities, as shown by the accompanying Table No. 1, that the committee has devoted its attention almost entirely to this subject up to the present time.

TABLE NO. 1.

Table of Valuations for the Specific Resistance of Pure Copper at 0° C. in Legal Michroms, selected from various electrical papers and text-books.

| Authority. | Sp. Res. of Copper. | | Probable Source. |
|---|---|---|---|
| | Hard. | Soft. | |
| Matthiessen, *Phil. Mag.*, 1865, No. 1 ... ... | 1·624 | ... | Table No. II., p. 362. |
| Matthiessen, *Phil. Mag.*, 1865, No. 2 ... ... | 1·634 | 1·598* | Metre-Gramme standard, Table No. 3, p. 363. |
| Matthiessen, B.A. Report, 1864, No. 3 ... ... | ... | 1·557 | Standard Mile Unit corrected for temperature (15·5° C.). |
| F. Jenkin's "Electricity and Magnetism" ... F. Jenkin's and B.A. Report, 1873 ... ... | 1·634 | 1·598 | Matthiessen's Standard for copper, other values in same report, from lead standard. |
| Everett's "Units and Physical Constants," 1885 ... | 1·611 | ... | Based on mercury ohm = 94,340. |
| Everett's "Units and Physical Constants," 1886 ... | 1·620 | 1·584 | Jenkin's table. |
| Everett's "C.G.S. System Unit," 1891 ... ... | 1·616 | 1·580 | |
| Gordon "Electricity and Magnetism," 1880 ... | 1·634 | 1·598 | From Everett's "Units and Physical Constants," 1st edition. |
| Maxwell's "Electricity," 1881 ... ... ... | 1·624 | ... | Matthiessen's No. 1. |
| Mascart and Joubert, "Electricity and Magnetism," 1888 ... ... ... | 1·621 | 1·584 | Matthiessen's No. 1. |
| Gray's "Absolute Meas.," 1888 ... ... ... | ... | 1·598 | Jenkin's table of Matthiessen's No. 2 value. |
| Gray's "Absolute Meas.," 1888 ... ... ... | 1·624 | ... | Wire table from Matthiessen's No. 1 value. |
| Ayrton's "Practical Electricity" ... ... ... | 1·634 | 1·598 | |
| Stewart and Gee's "Practical Physics" ... ... | ... | 1·598 | |
| Hospitalier, "Formulaire," 1891 ... ... ... | 1·620 | ... | |
| Munro & Jamieson's Pocket Book, 1891, p. 189 and p. 194 b ... ... ... | 1·642 | 1·615 | |
| Munro & Jamieson's Pocket Book, 1891, p. 194 a ... | ... | 1·598 | Matthiessen's No. 2. |
| Dr. Fleming, *Electrician*, London, Vol. xx., p. 471... | 1·624 | ... | Matthiessen's No. 1. |
| W. H. Preece, Paper, London Inst. E.E., December 10th, 1891 ... ... | 1·616 | 1·580 | |
| Anthony & Brackett, "Text-Book of Physics," 1887... | ... | 1·611 | |
| Slingo and Brooker's *Elec. Engineering*, 1890 ... | 1·634 | 1·598 | F. Jenkin. |
| Houston's "Dictionary of Elec. Terms," 1889 ... | 1·634 | 1·598 | F. Jenkin. |
| Boult's Comprehensive International Wire Table, 1890 ... ... ... | ... | 1·557 | Matthiessen's mile standard. |

* Standard recommended by committee.

The committee, after careful consideration, came to the conclusion that Matthiessen's "mile standard" (one statute mile of copper wire $\frac{1}{10}$th inch in diameter, having a resistance of 13·59 B.A. units at 15·5° C.) is not the correct one, although very commonly used. Matthiessen himself did not place much confidence in this "mile standard." The committee, acting under instructions from a meeting of the Institute, held September, 1890, has based all standards and values in this report upon soft or annealed copper, since its properties are reasonably constant and reliable. It has purposely excluded from its recommendations all standards and values based upon hard copper, although several were given by Matthiessen, because the hardness of copper is merely relative, and the resistance of hard copper may vary between wide and uncertain limits depending upon the *degree* of hardness.

As to the fact often brought up that copper may be found

which shows one or two per cent. higher conductivity or less resistance than Matthiessen's standard, we are of the opinion that this is no real objection, provided the value of the standard is definite and generally accepted. A standard which is not the highest attainable value may even be considered an advantage, since the average commercial wires will approximate to it more closely.

Although we believe the standard we recommend will answer the purpose temporarily, and probably permanently, nevertheless we think that if a thoroughly correct and complete redetermination of the standard resistance of copper could be accomplished, it would be a benefit to electrical science and industry. Favourable offers in this direction have already been received by this committee from Johns Hopkins University, Cornell University, and Columbia College, and it is likely that this redetermination may be undertaken.

The following statement of the most important and reliable figures and facts given by Matthiessen will serve to show the derivation of the standard which we recommend.

A hard-drawn copper wire 1 metre long, weighing 1 gramme ("metre gramme"), has a resistance of ·1469 B.A. unit at the temperature of 0° Centigrade.*

Matthiessen also gives the resistance of a hard-drawn copper wire 1 metre long and 1 millimetre in diameter ("metre millimetre") as ·02104 B.A. unit at 0° C.*

This implies a specific gravity of 8·89 for the copper used by Matthiessen, but unfortunately he neglected to actually determine the specific gravity.

Matthiessen's figures for relative conducting power are: †

| | |
|---|---|
| Silver ... ... ... ... | 100 |
| Hard or unannealed copper ... ... | 99·95 |
| Soft or annealed copper ... ... | 102·21 |

From this the resistance of Matthiessen's hard copper is found to be 1·0226 times that of soft copper, therefore, the resistance of a soft copper wire 1 metre long, weighing 1 gramme "metre gramme," is 0·14365 B.A. unit at 0° C., and this is the fundamental standard recommended by the committee.

From this standard, with the specific gravity of copper 8·89 assumed by Matthiessen, are derived the following sub-standards:—

A soft copper wire 1 metre long and 1 millimetre in diameter ("metre millimetre") has a resistance of 0·02057 B.A. unit at 0° C.

A cubic centimetre of soft copper has a resistance of 0·000001616 B.A. unit at 0° C.

A soft copper wire 1 foot long and $\frac{1}{1000}$th of an inch in diameter ("mil-foot") has a resistance of 9·720 B. A. units at 0° C.

Taking one B. A. unit as ·9889 legal ohm or 0·9866 new standard ohm, any of the above values may be converted into these units.

TABLE No. II.

Matthiessen's Standard recommended by the Committee.

| | B. A. U. | Legal ohms. | New ohms. |
|---|---|---|---|
| Equivalent length of a sq. mm. mercury column. | 104·8 cms. | 106·0 cms. | 106·3 cms. |
| Resistance at 0° C. of Matthiessen's standard— | | | |
| "Metre-Gramme" soft copper ... ... ... | ·14365 | ·14206 | 0·14173 |
| "Metre-Millimetre" soft copper ... ... ... | ·02057 | ·02035 | 0·02030 |
| "Cubic Centimetre" soft copper ... ... ... | ·000001616 | ·000001598 | 0·000001594 |
| "Mil-Foot soft copper ... | 9·72 | 9·612 | 9·59 |

The conductivity of copper at temperatures other than 0° Centigrade may be determined by using Matthiessen's formula $C_t = C_0 (1 - ·00387\ t + ·000009009\ t^2)$ in which $C_t$ is the conductivity at the given temperature, $C_0$ is the conductivily at 0°, and $t$ is the given temperature in degrees centigrade. It should be carefully noted, however, that this formula refers to *conductivity*. Therefore in order to apply it to resistance it is necessary to take the reciprocal, and this should not be done by merely changing signs, which is not mathematically correct, although often given in that way. The correct modification of Matthiessen's formula when referred to resistance is difficult to express accurately for any considerable range of temperature without increasing the number of terms in the formula, which would be very objectionable for practical work. The committee has therefore calculated a table of temperature co-efficients within the range of ordinary requirements. This seems to be the best plan to secure accuracy and convenience.

* *Philosophical Magazine*, May, 1865.
† *Philosophical Transactions*, 1864.

TABLE No. III.

Table of Temperature Variations in the Resistance of Pure Soft Copper according to Matthiessen's standard and formulæ.

| I. | II. | III. | IV. | V. | VI. |
|---|---|---|---|---|---|
| | | | Matthiessen metre-gramme standard resistance. | | |
| Temp. °C. | Temperature co-efficient of resistance. | Logarithm. | B. A. Units. | Legal ohms. | New ohms. |
| 0 | 1·0 | 0· | 0·14365 | 0·14206 | 0·14173 |
| 1 | 1·003876 | 0·0016801 | 0·14421 | 0·14261 | 0·14228 |
| 2 | 1·007764 | 0·0033588 | 0·14477 | 0·14317 | 0·14283 |
| 3 | 1·01166 | 0·0050362 | 0·14533 | 0·14372 | 0·14338 |
| 4 | 1·01558 | 0·0067121 | 0·14589 | 0·14427 | 0·14394 |
| 5 | 1·01950 | 0·0083864 | 0·14645 | 0·14483 | 0·14449 |
| 6 | 1·02343 | 0·0100593 | 0·14702 | 0·14539 | 0·14505 |
| 7 | 1·02738 | 0·0117307 | 0·14759 | 0·14595 | 0·14561 |
| 8 | 1·03134 | 0·0134003 | 0·14815 | 0·14651 | 0·14617 |
| 9 | 1·03531 | 0·0150683 | 0·14873 | 0·14708 | 0·14673 |
| 10 | 1·03929 | 0·0167346 | 0·14930 | 0·14764 | 0·14730 |
| 11 | 1·04328 | 0·0183993 | 0·14087 | 0·14821 | 0·14786 |
| 12 | 1·04728 | 0·0200621 | 0·15045 | 0·14878 | 0·14843 |
| 13 | 1·05129 | 0·0217230 | 0·15102 | 0·14935 | 0·14900 |
| 14 | 1·05532 | 0·0233821 | 0·15160 | 0·14992 | 0·14957 |
| 15 | 1·05935 | 0·025039 | 0·15218 | 0·15049 | 0·15014 |
| 16 | 1·06339 | 0·026694 | 0·15277 | 0·15107 | 0·15071 |
| 17 | 1·06745 | 0·028348 | 0·15334 | 0·15164 | 0·15129 |
| 18 | 1·07152 | 0·029999 | 0·15393 | 0·15222 | 0·15186 |
| 19 | 1·07559 | 0·031648 | 0·15451 | 0·15280 | 0·15244 |
| 20 | 1·07968 | 0·033294 | 0·15510 | 0·15338 | 0·15302 |
| 21 | 1·08378 | 0·034939 | 0·15569 | 0·15396 | 0·15360 |
| 22 | 1·08788 | 0·036581 | 0·15628 | 0·15455 | 0·15418 |
| 23 | 1·09200 | 0·038222 | 0·15687 | 0·15513 | 0·15477 |
| 24 | 1·09612 | 0·039859 | 0·15746 | 0·15572 | 0·15535 |
| 25 | 1·10026 | 0·041494 | 0·15806 | 0·15631 | 0·15594 |
| 26 | 1·10440 | 0·043127 | 0·15865 | 0·15689 | 0·15653 |
| 27 | 1·10856 | 0·044758 | 0·15925 | 0·15748 | 0·15711 |
| 28 | 1·11272 | 0·046385 | 0·15985 | 0·15808 | 0·15770 |
| 29 | 1·11689 | 0·048011 | 0·16044 | 0·15867 | 0·15830 |
| 30 | 1·12107 | 0·049633 | 0·16105 | 0·15926 | 0·15889 |
| 40 | 1·16332 | 0·065699 | 0·16711 | 0·16526 | 0·16488 |
| 50 | 1·20625 | 0·081436 | 0·17328 | 0·17136 | 0·17095 |
| 60 | 1·24965 | 0·096787 | 0·17952 | 0·17753 | 0·17711 |
| 70 | 1·29327 | 0·111687 | 0·18578 | 0·18372 | 0·18329 |
| 80 | 1·33681 | 0·126069 | 0·19204 | 0·18991 | 0·18946 |
| 90 | 1·37995 | 0·139863 | 0·19823 | 0·19604 | 0·19558 |
| 100 | 1·42231 | 0·152995 | 0·20432 | 0·20206 | 0·20158 |

Respectfully submitted,

FRANCIS B. CROCKER, *Chairman.*

LOUIS DUNCAN, E. WILBUR RICE, Jun.,
WM. E. GEYER, E. P. ROBERTS,
A. E. KENNELLY, HARRIS J. RYAN,
GEO. B. PRESCOTT, Jun., WM. STANLEY, Jun.,
SCHUYLER S. WHEELER,
*Committee on Standard Wiring Table.*

The report of the "Standard Wiring Table Committee," presented at a meeting of the Institute, November 18th, 1890, was referred by the council to the regular committee on "Units and Standards," and has been somewhat modified, particularly in regard to the correction for temperature.

*Committee on Units and Standards.*
A. E. KENNELLY, *Chairman,*
FRANCIS B. CROCKER,
WILLIAM E. GEYER,
GEO. A. HAMILTON,
GEO. B. PRESCOTT, Jun.

Appendix IV., embodying an international system of notation and conventional symbols for designating different quantities, suggested to the last congress by Mr. E. Hospitalier, of Paris, will be published hereafter.

CARL HERING,
*Chairman, Sub-Committee on Provisional Programme.*

## SOUND AND VIBRATION.

SPEAKING at the Royal Institution last Saturday, Lord Rayleigh discussed, with that simple manner which is characteristic of his popular lectures, some of the fundamental questions of acoustics. If you have a number of equal sources of sound in close proximity to one another, what will be the resultant intensity? This was decided by the lecturer to be merely a matter of chance. By multiplying, without limit, the number of sources of sound, it might be supposed that every possible combination among them would occur and we should be able to arrive at an answer. For instance, suppose you had 10,000 sources of sound, it could be imagined that you would have 100 times the intensity of a single source, that being the square-root of 10,000, the resultant amplitude. The assumption is, however, too wide; the only question you can answer is: What is the *probable* intensity of the resultant sound? It can be shown that there is always a reasonable chance of intensity varying over a great range, it may be half or double the average. This is a little paradoxical, because you would naturally expect, with 10 violins playing, to get a definite result; but even in that case the total effect as regards intensity is a matter of chance; the intensity fluctuates, but the variations do not strike the ear in a conspicuous manner. One question can be definitely answered: Suppose you do not make merely one trial but an immense number of trials, taking, say, ten sources of sound, measuring their individual intensities and comparing this with the intensity of their compounded effect in an immense number of trials, it will be found that there is a mean resultant intensity proportional to the square root of ten.

In order to show the case of superimposed vibrations, Lord Rayleigh exhibited a Blackburn's pendulum. Three cords were joined together at one end of each of them so as to form a Y, the two top ends were attached to the ceiling at a few feet apart from one another; the third cord, which hung down, carried at its lower end a large funnel filled with sand, which took the place of a pendulum bob. Two motions were given to the funnel, one in the plane of the Y, about the middle point of the strings; the other at right angles to this, about the two fixed points of suspension. Beneath the funnel was a large sheet of paper upon which the sand traced the curve corresponding to the twofold motion. The application of these superimposed vibrations to the case of a sonorous body, vibrating in two or more independent modes, having two or more periods, was then explained.

As an acoustical example of a simple harmonic motion, a string vibrating in a direction at right angles to its length was considered. Its vibrations were shown to take the form either of progressive or stationary waves, a wave of the sea being the representative of a progressive harmonic motion. A progressive wave was produced on the string by giving a sudden blow to one end. Travelling to the other end, it returned to the starting point. A stationary wave was described as being such that every point of the vibrating body is passing through its position of equilibrium at the same moment of time—such is the vibration of the string of a musical instrument.

Referring to the reflexion of sound, the lecturer explained why a tramcar passing, say, from north to south along a main road, may sound, to an observer stationed in a side street, which crosses the main road, say, east and west, as though it were passing from south to north. By drawing lines to represent the reflexions from the houses, &c., it was shown that the direction in which the reflected wave reaches the observer may be quite different to the imagined direction of the tramcar.

As a further instance of the reflexion of sound, Lord Rayleigh said that if an electric bell were kept sounding opposite one face of a house, a listener stationed round either corner would probably hear it, but that the intensity of the received sound would be much increased if a drawing board were placed at the corner in such a way as to reflect the wave from the bell to the listener. The effect of acoustic shadows was shown by interposing the hand between a sounding body and a sensitive flame.

## A BRIEF HISTORY OF THE INCANDESCENT LAMP LITIGATION.*

THE incandescent lamp situation has attracted so much attention of late that a brief statement of the more important suits both in this country and abroad, may prove of some interest.

It was on November 9th, 1879, that Edison made his application for the patent which was granted to him on January 27th, 1880. The application of Sawyer and Man for a paper carbon filament was filed on January 9th, 1880. On September 23rd of the same year an interference was declared. The Examiner of Interferences on January 20th, 1882, awarded priority to Sawyer and Man, but on July 24th of that year this decision was set aside by the Commissioner. On June 2nd the Examiner rendered a second decision in favour of Sawyer and Man, which, on July 28th of the same year, was reversed by the Examiners-in-Chief. The Commissioner of Patents, on October 8th, 1883, confirmed the decision of the Examiner and awarded priority to Sawyer and Man, but on the 17th of the same month Mr. Edison appealed to the Secretary of the Interior, who on November 19th, 1884, dismissed the appeal. Five days later, on November 24th, Mr. Edison made a motion for a re-hearing of the case before the Commissioner, which on the following April 2nd, was denied by the Acting Commissioner. On May 12th, 1885, a patent was issued to Sawyer and Man, and on the following June 27th the Patent Office refused to institute a new interference. The Sawyer-Man Company brought suit against the Edison patent in the famous McKeesport case, which resulted, it will be remembered, in Justice Bradley dismissing the case. Later, the Edison Electric Light Company brought suit against the United States Electric Light Company for infringement of its patent, which was not decided until July 14th, 1891, on which date Judge Wallace rendered a decision in favour of the Edison interests. This decision was sustained by the United States Circuit Court of Appeals, October 4th, 1892.

The most celebrated suit in England was that of the Edison and Swan United Electric Company, Limited, against Woodhouse & Rawson, of London, which was brought on May 6th, 1886, before Justice Butt, and which resulted in a decision in favour of the Edison & Swan Company.

In Germany, Messrs. Siemens & Halske entered into an agreement with Edison to the effect that they should manufacture Edison lamps and build Edison dynamos in Germany, while Edison received the privilege of building the Siemens dynamo in England, where Siemens had taken out a patent on the Hefner-Alteneck armature in 1873, this armature being common to both the Edison and Siemens types of dynamo.

## THE GOEBEL DEFENCE.

IN giving judgment in the case of the Beacon Vacuum Pump Company, to which we refer in our Notes pages, Judge Colt said :—

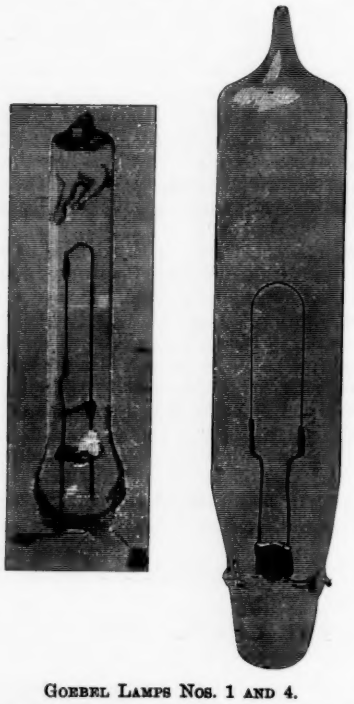
Upon consideration of the whole of the evidence on this motion I have reached the following conclusion :—

It is extremely improbable that Henry Goebel constructed a practical incandescent lamp in 1854. This is manifest from the history of the art for the past fifty years, the electrical laws which since that time have been discovered as applicable to the incandescent lamp, the imperfect means which then existed for obtaining a vacuum, the high degree of skill necessary in the construction of all its parts, and the crude instruments with which Goebel worked.

Whether Goebel made the fiddle-bow lamps 1, 2, and 3, it is not necessary to determine. The weight of evidence on this motion is in the direction that he made these lamps or lamps similar in general appearance, though it is manifest that few, if any, of the many witnesses who saw the Goebel lamp could form an accurate judgment of the size of the filament or burner. But assuming they were made, they do not anticipate the invention of Edison. At most they were experimental toys used to advertise his telescope, or to flash a light upon his clock, or to attract customers to his shop. They were crudely constructed, and their life was brief. They could not be used for domestic purposes. They were in no proper sense the practical commercial lamp of Edison. The literature of the art is full of better

* New York *Electrical World*.

lamps, all of which were held not to anticipate the Edison patent. The prior art demonstrates that to protect a carbon filament $\frac{10}{1000}$ths of an inch in diameter from speedy disintegration, the lamp chamber must maintain a nearly perfect and stable vacuum, and every part of the structure must be composed of such materials and so put together as not to imperil this vital condition. Leaving out other defects, it is abundantly shown that the Goebel lamp did not possess this requirement, and could not by reason of the elements which entered into its composition, and the mode in which it was constructed. Goebel says he made more than a hundred lamps, and that a continual improvement took place in their construction, and yet the only three lamps produced at the hearing by his own confession were made as early as 1854, or before gas was introduced into his house. Where are the other lamps which show these improvements except exhibit 4, which I will deal with presently? The evidence of Goebel and his witnesses point to the conclusion that work ceased on these lamps in the "fifties," and was not revived until Edison twenty years later startled the electric world with his invention. Goebel brought from Germany the ideas contained in the old lamp of Starr, with its carbon pencil enclosed in a Torricellian vacuum, and he probably constructed some lamps after that pattern. In doing this he was up to and in line with the art as it existed at that early day, but to say that with a sudden bound he jumped from Starr to Edison passes the limits of credulity. The history of great inventions shows a gradual and laboured progress. Each new investigator records some advance until it may be the desired discovery is almost within his grasp, but it is only after many attempts and many failures that some one appears who accomplishes the long sought for result. The discovery of the domestic incandescent lamp is no exception to this rule, as the record in the New York case bears witness. Speaking from the standpoint of the art of incandescent lighting in 1854, and in 1892, are two different things, and it is, therefore, quite easy for witnesses to think that Goebel did much more than there is any legitimate reason to suppose.



Goebel Lamps Nos. 1 and 4.

As for Lamp No. 4, I cannot but view it with suspicion. It presents a new appearance. The reason given for not introducing it before the hearing is unsatisfactory. This lamp, to my mind, envelopes with a cloud of distrust the whole Goebel story. It is simply impossible under the circumstances to believe that a lamp so constructed could have been made by Goebel before 1872. Nothing in the evidence warrants such a supposition, and other things show it to be untrue. This lamp has a carbon filament, platinum leading-in wires, a good vacuum, and is well sealed and highly finished. It is said that this lamp shows no traces of mercury in the bulb because the mercury was distilled, but Goebel says nothing about distilled mercury in his first affidavit, and twice he speaks of the particles of mercury clinging to the inside of the chamber, and that for this reason he constructed a Geissler pump after he moved to 468, Grand Street, which was in 1877. Again, if this lamp has been in his possession since before 1872, as he and his son swear, why was it not shown to Mr. Crosby, of the American Company, when he visited his shop in 1881, and was much interested in his lamps? Why was it not shown to Mr. Curtis, the leading counsel for defendants in the New York cases, when he was asked to produce a lamp and promised to do so? Why did not his son take this lamp to Mr. Bull's office in 1892, when he took the old fiddle-bow lamps 1, 2, and 3? Why did not his son take this lamp to Mr. Eaton's office in 1882, when he tried to negotiate the sale of his father's inventions to the Edison Company? A lamp so constructed and made before 1872 was worth a large sum of money to those interested in defeating the Edison patent like the American Company, and Goebel was not a rich man. Both he and one of his sons were employed in 1881 by the American Company. Why did he not show this lamp to McMahon when he called in the interests of the American Company and talked over electrical matters? When Mr. Dreyer tried to organise a company in 1882, and procured an option from him of all his inventions relating to electric lighting, for which $925 was paid, and when an old lamp of this kind was of vital consequence and would have insured a fortune, why was it not forthcoming? Mr. Dreyer asked Goebel to produce an old lamp and was especially anxious to find one pending his negotiations with the Edison Company for the sale of Goebel's inventions. Why did he not produce this lamp in his interviews with Bohm of the American Company, or Moses of the Edison Company, when it was for his interest so to do? The value of such an anticipation of the Edison lamp was made known to him. He was desirous of realising upon his inventions. He was proud of his incandescent lamps, and was pleased to talk about them with anybody who would listen. Is it conceivable, under all these circumstances, that he should have had this all-important lamp in his possession from 1872 to 1893, and yet no one have heard of it or seen it except his son? It cannot be said that ignorance of the English language offers an excuse. He knew English very well, although Bohm conversed with him in German. His children spoke English. Neither his ignorance nor his simplicity prevented him from taking out three patents, the first in 1865 for a hemmer, and the last in 1882 for an improvement in incandescent lamps. If he made lamp No. 4 previous to 1872, why was it not also patented?

There are other circumstances which throw doubt on this alleged Goebel anticipation. The suit against the United States Electric Lighting Company was brought in the Southern District of New York in 1885. Large interests were at stake, and the main defence to the Edison patent was based upon prior inventions. This Goebel claim was then investigated by the leading counsel for the defence, Mr. Curtis. It was further enquired into in 1892, in the case against the Sawyer-Man Company. It was brought to the attention and considered by the Edison Company in 1882. It was at that time known to the American Company, who hoped by this means to defeat the monopoly under the Edison patent. Dreyer tried to organise a company for its purchase. Young Goebel tried to sell it. It must have been known to hundreds of people. And now when the Edison Company, after years of litigation, leaving but a short time for the patent to run, have obtained a final adjudication establishing its validity, this claim is again resurrected to defeat the operation of the judgment so obtained. A Court of Equity should not look with favour on such a defence. Upon the evidence here presented, I agree with the first impressions of Mr. Curtis, and with the opinion of Mr. Dickerson, that whatever Goebel did must be considered as an abandoned experiment.

It has often been laid down that a meritorious invention is not to be defeated by something which rests in speculation or experiment, or which is rudimentary or incomplete. The law requires not conjecture, but certainty. It is easy after an important invention has gone into public use for persons to come forward with claims that they invented the same thing years before, and to endeavour to establish this by the recollection of witnesses as to events long past. Such evidence is to be received with great caution, and the presumption of novelty arising from the grant of the patent is not to be overcome, except upon the most clear and convincing proof. *Coffin* v. *Ogden*, 18 Wall, 120; *Brush* v. *Condit*, 132 U.S. 39; *The Telephone Cases*, 126 U.S.; *American Bell Telephone Company* v. *People's Telephone Company*, 22 Fed. Rep. 309; *Motte* v. *Bennett*, 2 Fisher, 642; *Parham* v. *American Buttonhole Company*, 4 Fisher, 468; *La Baw* v. *Hawkins*, 1 Ban. & Ard. 428; *Gottfried* v. *Philip Best Brewing Company*, 5 Ban. & Ard. 4; *Worswick Manufacturing Company* v. *City of Buffalo*, 26 Fed. Rep. 128.

When the defendant company entered upon the manufacture of incandescent lamps in May, 1891, it well knew the consequences which must follow a favourable decision for the Edison Company in the New York case.

Owing to the large interests involved, I have carefully considered this motion, and I am satisfied upon the evidence, and the law applicable thereto, that it should be granted.

*Injunction granted.*

## EALING ELECTRIC LIGHTING.

The following is an abstract from Messrs. Bramwell and Harris's report on the proposed electric lighting of the Ealing district:—

In accordance with the intimation contained in the letter of your surveyor, Mr. Jones, received by us on December 20th, that the Local Board desired us to "Report as to the best scheme to be adopted for lighting the district," we have made a careful inspection, and have given the matter our earnest attention and consideration.

We think it well to direct attention to three or four important points which will require the consideration of the board, before the adoption of electric lighting in the district can be finally determined upon.

We are of opinion that there are peculiar circumstances connected with the case of Ealing, which render it desirable that the local authority should itself undertake the lighting of its district.

The district over which the jurisdiction of the local authority extends is one covering a large area (some five square miles), and we find that the streets scheduled in the Ealing Electric Lighting Order, wherein the mains have to be laid, and electricity at once supplied (hereinafter called the "obligatory area"), do not lie in a small compass, but extend the whole length of the district from east

to west (some two miles), and also extend from north to south, some one and a quarter miles.

Further, the question as to the site available for the electric light generating station has to be considered. Upon this point we learn that there are two places in Ealing where there is land already the property of the local board, which might well be employed for the erection of the electric generating station:—(1) A piece of land nearly at the extreme west of the district and close to the railway, known as the Drayton Green siding; and (2) The spare piece of land at the sewage and destructor station, which is at the extreme south of the district.

We inspected both these sites. As regards the first, we found the area was amply sufficient for the purpose, and that, owing to its proximity to the railway, coal could readily be delivered there. If there were not other considerations which render the second site more satisfactory, we should have no hesitation in recommending you to erect the electric lighting station at the Drayton Green siding, although its electrical position is not as central as could be desired. The second site, that at the destructor, or sewage station, is, as we have said, at the extreme south of the district to be supplied. Electrically speaking, therefore, its position is no more satisfactory than site No. 1, but on inspection we found that this apparent disadvantage was not, owing to the proximity of large houses (likely to require the light), so great as at first sight it seemed to be; and further, we found there were other advantages (to which we will next call attention), which counterbalance this disadvantage, and render the site, in our judgment, very satisfactory; and we most strongly recommend that some of the spare land there should be utilised for the erection of the lighting station. It will be remembered that the dust-bin refuse of the district (which the local board themselves collect) is burnt at this station to destruction in the destructors and the "fume cremator." In order to satisfactorily complete the process of destruction of this refuse, a great heat has to be generated by the "fume cremator." A portion of this heat is already employed to generate steam, which is used to drive the engines in the sewage works, but a considerable portion still passes away to waste in the chimney, and some of this may well be utilised to assist in generating steam for the engines driving the electric light plant. Further, one of the needs of an economically working electric lighting station is a large supply of water for steam condensing purposes. We find upon enquiry that there is no place in Ealing where such a supply can, with certainty, be obtained, unless it be from the water company's mains, and the expense of the water purchased in this way would probably be such as to render its use prohibitory. At the sewage station there is at present passing away some 600,000 gallons of sewage effluent per 24 hours; this sewage effluent has been brought by your processes to such a state of excellence, that before it leaves the premises it could be satisfactorily employed for the purposes of steam condensing. These two advantages, therefore (1) the utilisation of the waste heat from the destructors, and (2) the utilisation of the sewage effluent for condensing purposes, with the further advantage that there is (as we have already said) at the sewage station spare land sufficient for the purpose, render it, in our judgment, unquestionable that the electric lighting station should be erected there, and that the local authority should themselves undertake the supply of electricity in their district. The disadvantage of this site for the lighting station is its position on the extreme southern edge of the district; in other words, it is some considerable distance away from certain portions of the area which will have to be be supplied with electricity.

It is apparent, therefore, that any system of low pressure electrical distribution, either with or without storage batteries, would be "economically" out of the question, and we are of opinion that a high pressure alternating current system with transformer stations, such as we are at present erecting for lighting the borough of Derby, should be adopted, as, with such a system, the disadvantage of the "electrical position" of the station is considerably minimised. Further, if an installation such as we have proposed, be established, at the sewage station, the disadvantage of being unable to employ storage batteries because of the alternating current will not be of importance, as, during the greater portion of each 24 hours, the waste heat of the destructors will be sufficient to do the whole work.

In regard to the first cost of establishing a satisfactory installation, it is necessary to consider what will probably be the needs for public lighting and for private lighting, and the questions at once arise of:—(1), What (if any) public lighting would it be advisable for you to undertake electrically, thus displacing the gas lamps, and saving the annual expenditure on these; and (2), What probability is there of the electric light being adopted in your district for private purposes within a reasonable time after the establishment of the station. As regards the first of these two questions, Mr. Jones informs us that the gas lighting in the scheduled streets (where, under your electric lighting order, the mains have to be laid, and electricity at once supplied) costs you a sum of £500 per annum; and, also, that the lighting of the Town Hall and other public buildings, costs a sum of £250 per annum. These amounts—together £750 per annum—would at once be saved by the establishment of the electric light; or rather, to put it more accurately, would at once become a revenue for the electric lighting station.

With respect to the private lighting. As we have said, we have carefully inspected the district, and have made such enquiries as seemed to us likely to enable us to come to a satisfactory conclusion, and we think, having regard to the class of the inhabitants, it is very probable that, when once the electric light is established, a reasonable amount of business for private lighting (the lighting of shops, banks, &c.) may shortly be anticipated.

The second of the above questions is one, however, upon which the Local Board themselves (with their intimate knowledge of the district and its needs) are much more competent to express an opinion than we can possibly be; but we are of opinion it could not be considered a sanguine estimate if you assume that, at the expiration of three years from the date of establishing electric lighting, the demand for private lighting would be equal to 5,000 lamps (each of 8 candle-power) installed.

In our judgment, therefore, the station should be so designed as to admit of ready and easy extension as the demands require it, but should, in the first place, allow of this number of lamps being installed for private lighting, in addition to the public lighting necessary for the streets scheduled in the electric lighting order.

We estimate the cost of providing on the ground which we have seen at the sewage and destructor station, an electric generating station, with buildings, boilers, machinery, mains, street lamps, &c., complete and at work, and designed so as to utilise the waste heat from the destructors and the sewage effluent for steam-condensing purposes, this station being capable of supplying electricity for the public lighting of the 3¼ miles of streets first to be lit, as well as for the private lighting of 5,000 lamps (each of 8 candle-power) installed at the sum of £21,000 (say £21,000).

As regards the probabilities of a return being realised by the undertaking, and when such return is likely to accrue. This, perhaps, is the most difficult question for us to deal with, but, speaking from the experience of other towns and districts, there is not much doubt that when once electric light begins to be taken up, the increase in demand is very rapid indeed. It cannot be assumed that from the first the installation will be worked at a profit. The board will, of course, realise that the working expenses of an electric lighting installation, like the working expenses of any other factory, do not increase in anything like the same ratio as the output, that is to say, when the installation is started the expenses will certainly be in excess of the revenue, and, until a large percentage of the output is being sold, the revenue and expenses will not balance. With further development the revenue will exceed the expenses; and when an enlargement of the installation becomes necessary, the cost of this enlargement will not be proportionately as great as the first cost, and it will enable a larger revenue to be earned with probably but little increase in the expenses. We estimate the annual working expenses of a station such as we have recommended, when fully at work, exclusive of the annual amount necessary for the repayment of principal and interest on the first cost of £21,000, and exclusive of rent of land, rates and taxes, as follows:—Annual cost of the lighting [when the whole of the 5,000 lamps, each of 8 candle-power, for the private lighting are installed, and the (say) 70 public (arc) lamps are also installed]:—

| | |
|---|---|
| Coal, slack, say ... ... ... ... ... | £210 |
| Superintendent of installation, engine room staff, out-door staff, linemen, &c., say ... ... | 700 |
| Small stores, oil, &c., say ... ... ... ... | 40 |
| Carbons for arc lamps, say ... ... ... | 100 |
| Actual working expenses ... ... ... | £1,050 |

*Depreciation:—*

| | |
|---|---|
| Repairs and renewal fund at various percentages according to the nature of the item, but averaging 5 per cent. on total cost ... ... | £1,100 |
| Total annual cost ... ... ... ... | £2,150 |

*Revenue:—*

PUBLIC (ARC) LIGHTING.

As we have already pointed out with regard to this, the electric lighting station would at once enter upon a revenue equal to the annual cost of the gas lamps displaced in the streets which are lit electrically, and of those displaced in the public buildings, together, £750 per annum. It must be remembered, also, that in fairness an addition should be made to this amount for the fact of the far superior illumination afforded by the electric light. We no not, however, make any addition for this to the above sum.

PRIVATE (INCANDESCENT) LIGHTING.

Assuming that the charge for the supply of electricity is equal to 8d. per Board of Trade unit (the price contemplated by the Ealing Electric Lighting Order), the average annual revenue to be derived from each 8-candle-power lamp installed may be taken as the sum of 9s.

With the whole 5,000 installed, the annual revenue from this source would therefore be £2,250.

The total annual revenue would therefore amount to—

| | |
|---|---|
| Public lighting ... ... ... ... ... ... | £750 |
| Private lighting ... ... ... ... ... ... | 2,250 |
| Together, say ... ... | £3,000 |

The difference between the above—

| | |
|---|---|
| Sums of revenue ... ... ... ... ... | £3,000 |
| And working expenses ... ... ... ... | £2,150 |
| That is the sum of ... | £850 |

represents the annual amount which could be devoted to rates and taxes, and to the repayment of principal and interest on the sum of £21,000, the first cost of the installation.

From the above it will be seen, therefore, that when the demand is such as to absorb the full capacity of a station such as we recommend, the undertaking will be practically self-supporting; and this condition of things will improve from time to time as the number of lamps increases beyond the 5,000, because while the revenue increases by each additional lamp, the working expenses would not increase in anything like the same ratio.

## WOODHOUSE AND RAWSON UNITED, LIMITED.

THE report of the Committee of Investigation into the affairs of the Woodhouse and Rawson Company, which was presented to the shareholders at their meeting on the 7th inst., is a document which cannot fail to impress investors with some idea of the vicissitudes to which companies paying 15 per cent. are subject, and there is, further, no question that in connection with some other electrical ventures which have assumed uncomfortable prominence an impression detrimental to electrical investments is liable to be formed. The shareholders of the company in question have received their dividends, when there were any, without enquiry into their source, and have authorised the creation of fresh capital as regularly as the dividends were declared, without enquiry into the reasons assigned for the additional capital, and without regarding the unsound features which were apparent to everyone else except themselves. The report of the committee seems thorough, and may come as a surprise to the shareholders, but will be very little of a surprise to many others, except as to some features which could only be known to those immediately concerned. When the company embarked upon that era of speculation which is doubtless responsible for its troubles, we called attention to the desirability of making up its mind which rôle to assume—manufacturing business, or company promotion. The probable result was foreseen by us, and needed only business aptitude to have been foreseen by anybody. Assets, which we presume have been entitled "securities" by courtesy, and valued at over £100,000 in July last, are practically unsaleable, have been cut down to £25,000. "Goodwill" and "Patents," previously assessed at over £170,000, are valued by the committee at £20,000. It was always incomprehensible to us why the shareholders released the guarantee fund and accepted the shadow of "confident assurance" for the substance of guarantee, or why the directors of the company recommended that it should be done. We now have the expression of the committee's opinion, that "if the shareholders had been told, or been allowed to know, in what way the profits of the first year had been arrived at, no sane shareholder would have consented to part with his guarantee." The report must itself be examined in order to arrive at any conception of the manner in which the business has been conducted by directors (whose holdings are comparatively microscopic), so as to show two years of brilliant prosperity, and a third year of utter collapse. A scheme of reconstruction is promised to be laid before an adjourned meeting. The shareholders should examine it carefully. But as to the impression to which we alluded above, we feel that it is not out of place to say that Woodhouse and Rawson is not, and has not for some years been, an electrical manufacturing concern at all.

## LEGAL.

### LANG v. THE HOUSE-TO-HOUSE ELECTRIC LIGHTING COMPANY, LIMITED.

His HONOUR (Judge Stonor) and a jury resumed and concluded the hearing of this action at Brompton County Court on Thursday afternoon in last week—too late for us to give more than the result in our impression of the following morning.

As at the previous hearing a fortnight before, when the case was not concluded, Mr. Lynden Bell, barrister, instructed by Mr. A. Slater, solicitor, of 70, Finsbury Pavement, appeared for the plaintiff; and Mr. Ruegg, barrister, instructed by Messrs. W. Hurd & Son, solicitors, of 25, Bucklersbury, for the defendant company.

The action, it will be remembered, was brought by the widow of the late Thomas Percy Lang, on her own behalf and on that of her two children, aged one and three years, respectively, to recover damages for the loss of his life in November last, consequent upon his having handled a live wire, the five-fold covering of which had become abraded, whilst he was engaged on behalf of defendants in attaching to the main a service wire to a private house in Roland Gardens, Kensington, from the main cable. The points for the decision of the Court and jury were whether there was negligence on the part of the defendants or their servants in using a dangerous system, and whether the deceased man was not guilty of contributory negligence in omitting to use the India-rubber gloves the defendants had provided for the handling of live wires.

The adjournment until last week was made for the purpose of enabling the defendant company to complete their evidence in continuation of that following the evidence for the plaintiff, which we reported in the ELECTRICAL REVIEW of February 24th.

On His Honour taking his seat at the appointed time, after a short period for luncheon, following his hearing of other cases,

Mr. RUEGG said he must apologise for the temporary absence of his witnesses, who had left the Court for 20 minutes, thinking that his Honour would take that usual time for his adjournment, instead of but 10 minutes.

His HONOUR said the learned counsel must go on; he could not help the non-attendance of his witnesses, for no more of whom, for his part, could he see the need. There was practically no dispute as to the facts, and in these they surely had enough on which to ask the verdict of the jury.

Mr. RUEGG said he was going to submit to his Honour that he had the authority of the High Court for saying there was no case of negligence to go to the jury on any of the points alleged.

His HONOUR said surely the opinion of the jury would be taken on the question of negligence, or not, arising out of the defendants' system. On that part of the case he thought there was strong evidence; the point against it was whether the deceased was contributory negligent.

Mr. RUEGG: There were specific allegations against them, one being that their cable was defective; but there was no scrap of evidence in proof of that.

His HONOUR: I don't think there is a doubt that the cable was defective; the point is, was it a defect you could have found out, and the evidence on that is very weak. I thought it was agreed on both sides that by some means the insulating material got broken off, or rubbed off, or was gnawed off by rats or mice; but it was in the iron pipe, and so not easily to be discovered or got at. Then something was said about a crack, but that point I think might be struck out.

Mr. BELL: I don't rely on that.

His HONOUR: Then we'll strike it out. The only point then will be—was there negligence on the part of the defendants by reason of the dangerous system of their working. There was also a charge of neglect on the part of the man having the superintendence of the work of making the junction between the main and the wire required to be attached to it.

Mr. BELL: Our case is that Taylor, who was admittedly the defendants' foreman, was negligent. We have the evidence of Mr. Gay, the secretary of the company, who said it was Taylor's duty to see the work completed before directing the current, which had been cut off, to be again put on.

His HONOUR: But isn't that included in the question of the system? Then comes the question if Lang was negligent in not using the gloves. I think, therefore, we may reduce the whole matter to these two points: (1), was there negligence on the part of the defendants or their servants by reason of the dangerous system of their working; and (2) was there contributory negligence by Lang.

Mr. RUEGG said after that clear expression of his Honour's intention of putting the case he would ask him to hear only one out of several witnesses he had intended to call, viz.,—

Mr. HENRY WHITE BOWDEN, engineer and assistant manager of the defendant company, who said he remembered the day of the accident, and giving orders for the work to be done. He also wrote the letters to the men warning them to use the gloves.

Mr. BELL: It is admitted we received it. What does it matter who wrote it?

WITNESS continued to say that he did not, of his own knowledge, know whether the gloves were taken and used that day.

By Mr. RUEGG: When the joint is made the last thing done is to pull in the slack?—Yes.

In so pulling in the slack is there any danger at all if the gloves are used?—No danger at all.

Is it in your experience a rare thing or a common thing for a little bit of the insulation to be rubbed off the wire?—Well, it certainly doesn't happen frequently.

You have a light which gives an indication of a defect in the cable. Was there any?

Mr. BELL: I have abandoned the defect.

His HONOUR: I think the only point upon which we could get further evidence is whether there was any difficulty or reason why the current is not turned off throughout the working.

Mr. RUEGG: Throughout the working it was turned off; you mean as to turning it on?

His HONOUR: Yes.

Examination continued: After the joint is made, is there not an arrangement by which the current is put on again?—I send up one of the electricians, either Taylor or somebody else, to connect on.

He gives you notice at the station, and you turn on?—No; he turns on.

Mr. BELL: If I don't cross-examine the witness, of course no unfavourable inference will be drawn from it.

Mr. RUEGG observed, then, he would formally submit that no case had been made out against the defendants, and proceeded to say he did this in view of a possible appeal, and he conceived he was bound, as a matter of precaution, to take this course.

His HONOUR: I think I can further simplify the case. With regard to damages, plaintiff is entitled, under Lord Campbell's Act, to recover for herself and two children pecuniary damage for the loss of her husband, but subject to the limitations of the Employers' Liability Act. His wages were 25s. a week, and the limit therefore would be £190 exactly.

Mr. BELL: To be divided between the mother and children.

His HONOUR: That is the limit. The question is what damages did she suffer, whether more or less. I should say her receipts could not possibly be brought to less than 10s. per week; and looking at the man's age, the prospect of her enjoying it would not be extravagantly put down at 10 years. That would be £260. Therefore it might be put to the jury that if they find for the plaintiff, they need not trouble themselves as to damages, which will be given for the full amount thus stated.

Mr. RUEGG said he was quite content to leave it to the jury.

His HONOUR: Then the two questions are negligence by a dangerous system of working, or contributory negligence.

Mr. BELL said he thought practically it came to that; but he also relied on negligence by Taylor, who had the superintendence of the work.

Mr. RUEGG then addressed the jury for the defence in a speech extending to nearly an hour in length. He and his learned friend were both indebted to his Honour (the learned gentleman said) for compressing the case into as small a compass as it could conveniently be brought, and in so clear a way, putting many questions which otherwise might lead to confusion. This case was, he need not say, one of great importance, both to the plaintiff and the defendants, and the questions, which were exclusively for their decision, had been compressed into two, bearing on the negligence of the defendants, or contributory negligence of the deceased man. A plaintiff in a case of this kind had to prove two things: (1) that the defendants were guilty of negligence; and (2) that he himself was not guilty of contributory negligence.

Mr. BELL: Not so; the onus is on you to prove contributory negligence.

Mr. RUEGG said then he would put it in this way: that defendants were guilty of negligence, and the jury also had to be satisfied that the deceased man was not guilty of negligence. This was the state of things which must exist before they could find a verdict for the plaintiff. The position he took up, and which the company had taken up from the commencement, was diametrically opposite to this, viz., that the company was guilty of no negligence at all, and that this poor man himself was guilty of negligence. Of course, that was a very serious, difficult, and important issue. One word before he came to the facts of the case. When a jury had a company—whether well-to-do or not, he did not know—on one side, and a poor widow on the other, there was great danger, and a natural danger, that they would sympathise with the widow, and so be quite unintentionally influenced by sympathy rather than by reason and justice. Sympathy was all very well in its way, but they were there not as sympathisers but as judges, conscientiously to say upon the evidence, and the evidence only, whether or not there was this negligence alleged against the defendants, or, rather, whether it was not attributable to the negligence of the unfortunate man himself. Now, what were the facts? The learned counsel proceeded to outline them, as shown by the evidence, saying the plaintiff had a considerable knowledge of the work in which he was engaged, though it was not suggested he was a skilled electrician, and he would know the danger of not exercising great care. He had for six months been engaged in this kind of work. During that time he had handled wires over and over again, and had attained such proficiency that he was competent to join a wire. So that he was not a novice, and it could not be contended that he did not know the danger and risk attendant upon the work which he appeared perfectly competent to do. It did not stop there. For in the most express way Mr. Gay, the manager, had been peculiarly careful to warn these workmen—of whom there would probably not be one in a thousand who would not readily handle the wires because they were insulated—that they must wear gloves when out jointing, and must in no wise handle the wires without them. More than this, gloves were at the work, but were not used by the unfortunate man, who was proved to have read the warning letter, and, smiling over it, thrown away the envelope. He (the learned counsel) had no doubt he thought, and numbers of his fellows had thought, the risk so extremely small as not to be worth providing against; but, unhappily, in this case the insulation had by some means been rubbed off. Where, then, was negligence on the part of the company? Mr. Gay had done everything to avoid all possibility of danger, and had his instructions been carried out no doubt the unfortunate man would have been alive to day. Something had been said about the gloves being dirty, but even if so a man might, through them, receive a shock, but he would scarcely be killed With absolute confidence, therefore, he submitted that everything that could have been expected to be done was done on behalf of the company, and it was only when people had become wise after the event that it had come to be seen how great a result could follow an apparently small omission. As to the point of the current not being kept turned off, the company worked under Board of Trade regulations, and it was actually turned off on this section from about 11 till 3, the wire being then dead and harmless.

His HONOUR: But it was turned on again before the slack was pulled in.

Mr. RUEGG said that it was proved the deceased man knew it was on again after the connection had been made, and having to deal with the wire when alive he should have worn the gloves. The answer of the defendants to the suggestion that their system was dangerous was that if carried out according to their instructions, there was not the slightest harm or risk attendant upon it. It was neither dangerous, defective, nor wrong; and had the deceased man followed his instructions he might have been alive now. As to the alleged refusal of gloves to the man, on which plaintiff at first relied, it had been proved that the incident in question referred not to this case but to another, and also to another and different matter. He submitted that the defendant company had done everything in their power to avoid all danger and risk, and that what happened in this case was brought about by the carelessness of the man who had unfortunately suffered the severest consequences therefrom. Lastly he reminded them that whilst generosity was an honourable trait in a man's character, there was a higher obligation even than that—namely, justice. By that he was content to ask the jury to deal with this case, remembering that he did not much blame the deceased, because he evidently thought that there was so slight a risk to be run in not wearing the gloves, as was indeed ordinarily the fact, though in this particular case there proved to be an exception to the rule in the insulation of the wire being by some means unknown rubbed off, thus exposing a small portion of it. The company having done nothing wrong in the matter, he confidantly appealed to them to say that they were entitled to the verdict in this action.

Mr. BELL, summing up the case for the plaintiff, said he should be content to leave it with the jury as it stood but for its great importance seeming to call upon him to gather up its points into as close a compass as possible, with the view of pointing out what was the case as presented from the plaintiff's point of view. He entirely agreed that they had nothing in that Court to do with sympathy, but simply to do what was just and right between the parties. Between responsibility of a criminal kind and as a civil matter, he reminded them there was a wide difference, and a verdict for the plaintiff in this case by no means involved their (the jury) laying their hands on any individual and say he was guilty of the death of this unfortunate man. The question they had to decide was something very different from that, viz., whether the deceased man knew, or ought to have known, that the current was turned on when he handled the wire, and whether, in that matter, there was what the law described as negligence on the part of the defendants or their servants. This, they should remember, was not an ordinary case, in which there was no difficulty in arriving at all the facts. Here the man was dead within a minute of the occurrence, and he was not here to explain what he had done or omitted to do. He admitted it must be taken the deceased knew the current was turned on; but notwithstanding that, he was going to ask them to say that his widow was entitled to recover for his loss. There were, in fact, but two points in the case. First, were the defendants the negligent; if they were not, there was an end of the case; and secondly, if they were negligent, was the unfortunate man negligent also, thus contributing to his death. He confidently submitted to them that there was negligence on the part of the defendants, in that the work of hauling in the slack was ordered after the current had been turned on, instead of hauling it in before. From 11 until 3 the wire was slack and dead, and there was no reason why the slack should not have been hauled in before the turning on. Taylor, the electrician in charge of the party, having made the junction, went away, leaving the deceased and Young to do the hauling in, and that, in itself, he submitted, was negligence. Seeing that a shock from a wire of very high power, as this was, would be sufficient to cause a man's death, the defendants should, as far as possible, have obviated the necessity of working at the live wire. He admitted it was absolutely necessary to touch it when the junction took place, and that this being a dangerous operation, gloves were provided with which to do it. Even in carrying out that connection with gloves there was some risk, and therefore the need for touching the wire should, as far as possible, have been minimised; but though necessary to touch the live wire for the connection, it was not so with regard to hauling in the slack. Mr. Gay himself had said it was Taylor's duty to see the work completed before directing the current to be put on. And Taylor did not do that. Instead of waiting for the work to be completed, he waited till the joint was completed, and left the wire still to be hauled in. This, he submitted, was negligence, for the work had not been completed. Beside the evidence that it was Taylor's duty to see the work completed before the current was turned on, there was the evidence of Mr. Swinburne that it would be better to finish the work and draw in the slack before doing the coupling. In saying this, and admitting that Mr. Gay had done all he could to prevent accident, he did not, of course, suggest any moral guilt on the part of Taylor, who was a young man, and may have thought the men could safely be left to pull in the slack without his presence. Suppose, however, they came to the conclusion that the defendant company was negligent through their servant, there remained—as he had said—the further point, Was the deceased man contributory negligent? for if they thought he was, his widow could not recover. He submitted to them that his non-compliance with the rule laid down in the notice did not amount to negligence; and for this reason: It was not necessarily neglect to disobey a regulation, and in this case, he submitted, this regulation had never been observed, and was practically in abeyance. The men were working for the company day after day without carrying it out, and this under the supervision of Taylor, who did not appear to have called their attention to it. The point for them was, Would an ordinarily careful man have abstained from wearing the gloves? and he submitted the deceased would not have thought it necessary, for the reason that he had worked, and was working with Young, who had been longer in the business, and had more experience than he, and Young—who was assisting in this hauling in—said he did not use the gloves except for the purpose of making the connection.

His HONOUR: That was all he did, wasn't it?

Mr. BELL: He helped to haul in the slack.

His HONOUR: Surely not.

Mr. BELL: He said he had often hauled in the wire, and he had never used the gloves, and Taylor said he never saw him use the gloves for hauling in.

Mr. RUEGG: Taylor said that his custom was when he had made the junction to go away.

Mr. BELL: No doubt; but he told us he had never seen the men using the gloves for hauling in the wire, and Young said "I never used the gloves for hauling in the wire, except for the purpose of making the junction." In fact, it was his custom to do exactly the acts which it is said the deceased man, with less experience and less responsibility, was negligent in doing. Did they think that being in the position of the deceased they would have done differently, and taken a protection which a senior and more experienced man omitted

to take, and had never in his life taken? Besides, might not deceased have read the instructions not to touch a high tension "main" wire without the gloves that it meant the main, and not merely the wire joined to it.

His HONOUR: It was the main wire, as I understand it, which caused the mischief.

Mr. BELL said whether that was so or not deceased had done what he did without remonstrance from the foreman or from Young, a more expert and experienced workman than himself. The order, in fact, he put it, had been practically annulled, with the consent of the foreman; and he would go further and ask the jury to believe that Young did not understand the order as going to the extent now submitted by the defendants. In conclusion the learned counsel reviewed the points to be decided by the jury, and whilst urging that there had been negligence on the part of the company, submitted, on the grounds he had already pointed out, that the deceased man was not guilty of negligence, and that they would be justified in coming to this conclusion on a careful review of all the facts and the surrounding circumstances, deceased having done what had been permitted and was permissible within the terms of the notice he received.

His HONOUR, in a very brief review of the case, said the facts were practically undisputed, and the jury therefore would not be troubled with the difficulties experienced in some cases of this kind. He would at the outset deal with some of the later observations of the learned counsel who had just closed an able address, and particularly the one where he spoke of the abrogation of the rule for dealing with these dangerous wires. Whether there were rules or not, a man was bound to take all proper precautions against accidents of whatever kind, and abrogation of the rule, if abrogation there were, would not relieve him from this obligation. He had the gloves by his side and could have put them on. But he (his honour) did not say that was conclusive on the point. The questions for them were—first, was there negligence on the part of the company? and, then, was there contributory negligence on the part of the deceased man? did he take all the precautions which a prudent and reasonable man would take in performing work of this kind, so as to shelter himself against risk and danger? If they thought that he did not take such precautions as would have protected him from this accident then they would find for the defendants. On the first of these questions they would have to consider whether the defendants' system of working was dangerous, that was, whether the turning on the electric fluid on this wire before the work was completed was negligent. It was not denied that the current was turned on before the work was finished, and that thus there was risk and danger which might have been avoided. It was for them to consider whether this was negligent or not. Then it was said that Taylor was negligent in that having the superintendence of the work of connection, he left the men, including the deceased, to finish it. It was for them to say whether he might not properly and fairly have trusted these men to do the remaining work, without involving themselves in the danger which befel the deceased. As to the question of contributory negligence, they had to consider was the dead man's non-consideration of the notice to wear the gloves disobedient. There were gloves there. They were not sent out to every man, and there were but two pairs for three people. It was for them to consider whether, under these circumstances, this was calculated to make men less careful in their work and liable to pay less attention to the notice. It was to be observed that if there was anything to be said on the absence of gloves they could have been asked for, in addition to the two pairs which were on the spot and not used in the work which proved fatal. It was quite clear that there was risk in handling the wire without gloves, and they had heard that there would be risk supposing the gloves proved defective, but that point did not arise in the absence of their being worn. What he proposed to do was to place in their hands a series of questions in writing, which they would please to answer Yes or No, and upon those answers their verdict would turn.

The jury taking the paper retired for consultation, and his Honour proceeded with some other cases. These being concluded just within an hour, and the jury not having returned, his Honour told counsel he proposed to ask them if they were agreed, and, if not, could he assist them.

This being done, they sent back to ask: Is it the defendants' usual system for the slack to be hauled in before the current is turned on?

His HONOUR, remarking: I think there was no evidence on that point.

Mr. BELL said, I suggested that it ought to be so.

His HONOUR: I must tell them there was no evidence, one way or the other, on this point.

Mr. BELL: I say there was evidence to this effect: I asked Taylor, why didn't you wait until after the hauling in, and the answer was, It was not our custom.

Mr. RUEGG: I think it was rather put the other way.

His HONOUR: Here is another question: "Was it usual for the slack to be hauled back?" The answer to that is, No.

These answers having been taken back to the jury by the bailiff in their charge, they remained in consultation some quarter of an hour longer, and then returned into Court.

His HONOUR taking from them the questions he had submitted, and their answers, said: The following are the questions I put:—

Was there negligence on the part of the defendants or their servants by reason of their dangerous system of working? and your answer is, Yes.

Did such negligence cause the accident?—Yes.

Was Taylor guilty of negligence in superintending the work on which Lang was engaged?—No.

Was Lang guilty of contributory negligence in not using the gloves?—Yes.

Did such negligence mainly or partly cause the accident?—Mainly.

That means (said His HONOUR) a verdict for the defendant company, and I enter judgment accordingly.

Mr. RUEGG asked would it be with costs; and His HONOUR replied: No; he thought not.

This concluded the proceedings.

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### TIENHOVEN AND BEVAN v. APPLETON AND CO.

THIS was an action referred to Mr. Hemming, Q.C., official referee of the High Court of Justice, and heard before him on the 6th and 7th inst. Mr. Chester Jones was counsel for the plaintiffs, and Mr. Rufus D. Isaacs (instructed by Mr. M. Mosely) was for the defendants. The plaintiffs are the present owners of Fenwick's patent, which is a process for recovering pure tin from tin scrap by electrolysis, and they granted a license to the defendants under certain terms and conditions, the material one of which was that the defendants were to treat such a quantity of the tin scrap as would enable them to judge of the merits or otherwise of the invention, and then in the event of the experiment showing a certain profit, they were to treat a certain quantity of scrap per month, and divide the profits as arranged in the license. The plaintiffs alleged that Messrs. Appleton, Burbey and Williamson had not sufficiently conducted their experiments so as to enable them to form an adequate opinion of the feasibility of the process being worked for commercial purposes, and in support of their contention, called Mr. Tienhoven, a commission agent, who stated that he had expended about £5,000 on the patent and had obtained one ton of pure tin, which he had sold in the market for £91; but on cross examination he was unable to state accurately the exact quantity of tin scrap he had treated in order to obtain that result, nor did he give the amount of protochloride of tin he had used in the process, nor did he give any figures showing what was the outlay required to produce the ton of tin. He stated that he had borrowed £2,500 from Mr. Bevan, but that the funds at their command for this purpose being exhausted, they applied to Appleton & Co. to conduct the working of the process, which they undertook to do if the results justified them in doing so. Tienhoven complained that Messrs. Appleton had conducted the experiments with insufficient apparatus, and also called his late manager in support of his case, but that gentleman said the apparatus used by defendants was quite in accordance with the specification, and he did not of his own knowledge know how much of the ton of tin was recovered from the tin scrap, or how much from the protochloride. For the defendants, Mr. Joseph Appleton said, that according to the plaintiffs' specification the process was unworkable from a commercial point of view owing to the difficulty in making a proper contact, and after treating nearly two tons of scrap, the result was about half a pound of tin, the greater part of which, in his opinion, came from the protochloride of tin, of which it was necessary to use a saturated solution, and which contained 55 per cent. of tin. He also stated that he had made numerous experiments both with Messrs. Tienhoven and Bevan and their foreman, also by himself, and was quite convinced of the worthlessness of the process for commercial purposes. In this he was borne out by Mr. T. E. Gatehouse, M.I.E.E., who stated he had a very large experience in most branches of electrical science and in the recovery of metals by electric processes, and that the patent was for all practical purposes worthless. Mr. Gatehouse explained the difficulty of making good electrical contact, and asserted that Messrs. Appleton had fairly carried out the experiments, the results of which were exactly in accordance with his own experiences. He alluded to the fact that tin on scrap metal varied considerably in thickness, and that when some pieces of scrap are denuded of tin others may not be half finished; also that in the electro-deposition of tin that metal is deposited on the cathode faster than it is precipitated from the anode, and that therefore much of the deposit comes from the tin in solution, which must be replenished; that the current density varies in different parts of the scrap, and that the iron residue was not a saleable article, as ironmasters would not have it as a gift. After Mr. Gatehouse's evidence, the official referee did not deem it necessary to call any further witnesses, and the plaintiffs' counsel having addressed the Court, the learned referee, without calling on the defendants, stated that in his opinion Messrs. Appleton had done all that was required of them; they had made proper experiments, and had supplied adequate apparatus, and had done everything to test the process and satisfy themselves that the profits represented to them by the plaintiffs could not be obtained, and that therefore the action must fail, and he gave judgment for the defendants with costs.

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### BOWES, SCOTT AND WESTERN v. CAUSTIC SODA AND CHLORINE SYNDICATE.

IN the Lord Chief Justice's Court last Monday, before the Lord Chief Justice and Mr. Justice Hawkins, an application was heard in the case of Bowes, Scott and Western *v.* The Caustic Soda and Chlorine Syndicate, Limited. The action is by plaintiffs, mechanical engineers, at Broadway Chambers, Westminster, against the defendant company to recover £250 for the purchase of certain patents in connection with an invention for extracting gold from ore. The present application was for summary judgment under the rules of the Court on an alternative claim based upon an agreement to the effect that if the defendants failed to form a company by December 31st to work three patents specified, £250 would become payable. The agreement was not carried out, and Mr. Justice Hawkins asked if it would not have been the height of dishonesty for the defendant company, if they came to the conclusion that they could not work the patents with success, to have sent out prospectuses inviting the public to take shares. He thought it would have been scandalous to have done so. Plaintiffs' counsel contended that the defendant company had become purchasers of the patents out and out, and that they were therefore entitled to claim. After discussion, their Lordships held that there were some questions for the Court to consider in the action, and gave the defendants leave to defend.

## ALABASTER AND OTHERS
*v.*
## THE MEDICAL BATTERY COMPANY, LTD.

*High Court of Justice.—Queen's Bench Division.*

[It is not our intention to comment on this case and the case of Tibbits *v.* Alabaster and others in the present issue, but we may possibly do so in that of next week. We cannot, however, defer tendering our hearty and grateful thanks to all those who have so kindly and considerately helped us with advice and evidence in maintaining in both actions the position we had taken up. It has been peculiarly gratifying to us to note the generously accorded support of our electrical contemporaries, whose unanimous and straight-forward expression of opinion on this, an electrical subject, redounds to the honour and honesty of those technical journals. Our witnesses bore the tedious waiting in the Courts with exemplary patience, and we feel we cannot too warmly express our obligations to the many friends who on both occasions rallied round us, either with direct aid, or with sympathy and congratulations.—EDS. ELEC. REV.]

THIS case came on before the LORD CHIEF JUSTICE and a Special Jury, on Tuesday, the 7th inst.

Mr. Finlay, Q.C., Mr. Lawson Walton, Q.C., and Mr. Bankes instructed by Messrs. Lewis & Lewis, appeared for the plaintiffs; Sir Edward Clarke, Q.C., and Mr. Germaine, instructed by Mr. Augustus Fleet, appeared for the defendants.

Mr. BANKES opened the pleadings

Mr. FINLAY: May it please your Lordship; Gentlemen of the Jury, the plaintiffs in this case are Messrs. Alabaster, Gatehouse & Company, and they are the proprietors and managers of a newspaper which is known as the ELECTRICAL REVIEW. The defendants, the Medical Battery Company, Limited, is a company which substantially belongs to a Mr. Harness, who carries on, and has carried on for some time, a very large business in the way of selling what are known as electropathic belts, which are recommended as a cure for almost every ill to which humanity is subject. The action is brought by the plaintiffs in respect of a libel circulated with regard to the plaintiffs in their characters as managers of this ELECTRICAL REVIEW by the defendant, and it took the form of a circular sent out by the defendant to almost all the newsvendors who are in the habit of selling such publications as the plaintiffs' and other periodical literature of the day. I will at once read the circular which forms the subject of complaint, in order that you may see exactly what you have to deal with. The circular was sent out by the defendant through his solicitor, and it is in these terms:—

"Sir, Having been consulted by my clients, the Medical Battery Co., Ltd., the proprietors of Harness's Electropathic and Zander Institute, of 52, Oxford Street, W., with reference to some malicious libels published in ELECTRICAL REVIEW and a paper called *Science Siftings*. I beg to give you notice, that if these or any future publications containing defamatory articles or paragraphs are sold or circulated by your firm, my clients will hold you responsible. In the same way you will be held responsible for the exhibition of any libellous bills or placards."

Now, that is a circular issued on behalf of the defendants, imputing to the plaintiffs that in their ELECTRICAL REVIEW they had inserted malicious libels upon the Medical Battery Company. The defendant, when he is sued in this action for that libel, says that the occasion was privileged, and that he sent it out to all those newsvendors for his own protection, and with the view of founding, possibly, proceedings against these newsvendors in respect of articles contained in the ELECTRICAL REVIEW, if, after that notice, they sold it. Gentlemen, you will have to judge of the *bona fides* of that defence, and I shall have to submit to my Lord, as a matter of law, that the allegation of a privileged occasion, in this case, absolutely fails the defendants. But it is imperatively necessary that you should understand the circumstances out of which this publication arose, and then you will be in a position to understand how far the defendant was speaking what he honestly believed when he spoke of these libels as malicious libels, or whether, on the other hand, he was not endeavouring, by use of these threats to newsvendors, to suppress criticism upon a system which was carried on with very great profit to Mr. Harness, but which evidently deserved the attention of the public press. Gentlemen, the Medical Battery Company, as some of you may be aware, for it has been very extensively advertised, has been formed for the purpose of selling what are known as electropathic belts. The patient has his choice of belts of different prices, and he is recommended to wear this belt under the idea that, if he wears it, currents of electricity will be generated, which will pass through the body, and which will cure him of the long list of disorders to which your attention will be called in some of the defendant's pamphlets. This system carried on by the Medical Battery Company was first brought prominently to the attention of the plaintiffs in this case by a case which was tried in the Bloomsbury County Court on the 19th July, 1892. Mr. Gatehouse is himself a distinguished electrician, and he was called as a witness in that case. It was a case in which a poor fellow of the name of Jeffery had been suffering from hernia. He went to the Institute of the Medical Battery Company, and he was there persuaded to buy for his hernia an electropathic belt at the price of five guineas. He was only able to pay down the sum of £2, and for the balance of £3 5s. the Medical Battery Company had, what I think you will say was, the assurance to bring an action in the County Court, claiming payment from this clerk of the balance. The case was fully investigated and heard in court, and Mr. Gatehouse gave evidence as an electrician on behalf of the defendant, stating what his opinion of this belt was. The case resulted in judgment for the defendant, on the ground that the belt was absolutely useless, and judgment against the Medical Battery Company that they should return the £2 which this poor fellow had been induced to pay on account of this five guinea belt. That was Mr. Gatehouse's introduction to close quarters with the Medical Battery Company. An account of the case and an article appeared in the ELECTRICAL REVIEW on the 22nd July. The case is set out at some length on page 99. A full report is given of what had taken place in Court, and of the judgment of his Honour, Judge Bacon. That report of the case, which I will not trouble you with reading at present, was followed by an article on page 101 of the ELECTRICAL REVIEW in these terms; and I think I ought at once to bring this article to your attention, as this forms the inception of the transactions into which you have to inquire:—

"Electropathic Belts.—The prestige (save the mark) of the so-called electric belts, supplied by the Medical Battery Company, received a severe blow in the Bloomsbury County Court on Tuesday last. The action, which was the means of exposing one of the grossest cases of misrepresentation of the present day, is reported at some length in our other columns, and is of special interest to electricians, because the evidence of an electrical expert was, for the first time, we believe, in the history of these so-called electro-medical appliances, added to other overwhelming testimony as to their worthless nature. The defendant in the action was advised to submit the belt to Mr. T. E. Gatehouse, who reported upon it. It consisted of the ordinary webbing, on one half of which were fixed 12 thin zinc stamped discs, about 1½ inches in diameter, and on the other half 12 copper discs, similar in shape and size, with their surfaces apparently tinned. The discs on either portion were connected up together, in two sets of six, by flexible metallic conductors, so that one half of the belt might be said to contain two zinc, and the other two copper, electrodes. On the external portion of the belt there was a small metal tube or socket in connection with each electrode, evidently with a view of applying electrical energy from an external source; and on the front half of the belt was a suspender with metallic webbing electrodes, connected by india-rubber covered flexible conductors, one to each set of zincs, but as this ornament was superfluous, so far as the patient was concerned, it is unnecessary to allude to it again. It was quite impossible for this belt to generate any current as worn upon the body, for the external circuit was not completed by the connecting up of the zinc and copper poles, nor were any means indicated to the defendant of doing so for himself."

I need not read the whole of the article, gentlemen. It goes on to explain the matter, and the reasons for that statement as to the absolute uselessness of such a belt; and then it contains this passage:—

"We have always contended that 'belts' such as that which was the bone of contention on Tuesday, give practically no current, even under the best conditions, and that most, if not all, of the insignificant quantity of electricity generated by such appliances flows along the *webbing of the belt itself* and partly, perhaps, over the *moist surface of the skin*. We are not alone in this opinion, but we do not know that any experiment, previous to what seems to be a conclusive one performed by Mr. Gatehouse just before the commencement of the action, had ever been made to settle this question."

Then details are given of that experiment.

"It is perfectly evident, therefore, from this experiment that the current which was flowing through the webbing of the belt itself is not increased by contact of the belt with the body when it (the latter) is in its normal state, and not wetted by the external application of liquid. This will be very satisfactory information to the medical profession, for doctors can now state positively that the current generated by these appliances does not overcome the skin resistance, and cannot therefore possibly influence the body. If the much-to-be-pitied individuals of both sexes who so readily fall into the snare set by the president of the *British Association of Medical Electricians* and of the Medical Battery Company, would only reason with themselves, a few minutes' reflection ought to convince the most foolish that the idea of a poor debilitated body generating the electricity for alleviating its own suffering is most preposterous. Indeed, the stepping stone from hallucinations of this kind to the borderland of a profound belief in perpetual motion can be but a narrow one. Their supposed curative results are fully accounted for by a kind of 'hypnotic suggestion' akin to the well-known effects of bread pills on sensitive organisms."

And then they go on thus:—

"But having satisfactorily disposed of the electrical pretensions of these patented articles, where can words be found sufficiently strong to condemn the practices carried on in the Oxford Street mansion in the treatment of rupture?"

Rupture or hernia was the complaint from which this poor fellow Jeffery had been suffering when he went to this Institution.

"That it should be possible in these days of enlightenment, and in the midst of the largest city in the world, for 16,900 cases of a serious malady to have been treated by a man having such qualifications for the task as the consulting officer of the Medical Battery Company proved himself in the witness box to possess, is beyond the comprehension of any reasonable being; and if ever there was a matter demanding the immediate attention of the Public Prosecutor, the revelations made at the Bloomsbury County Court point to it. If the treatment, by an unqualified man, of incurable disorders which require careful and skilful medical attention, is not actionable at law, the sooner some bill is passed through Parliament to make it so, the better for suffering humanity. It is bad enough that the male sex should submit to be 'examined' by these so-called 'experts,' but to think that gentle, refined, and highly sensitive women should be contaminated by the mere touch of such 'consulting officers,' is utterly abhorrent to the feelings of anybody possessed of a trace of morality or a scrap of manliness. We trust that the report of this disgraceful case may be disseminated far and wide, for it will do much to enlighten the public as to the real status of Mr. C. B. Harness, and the manner in which those who read, and are misled by his advertisements, are 'examined,' if by an unlucky chance they are led to consult the consulting officers of the concern over which he presides. No wonder that he can spend yearly in advertisements a sum which most people would consider a princely fortune, if 16,900 cases are treated at five guineas a time—probably more in numerous instances—in between six and seven years. Weight may, perhaps, be still further added to our comments, if we state that Mr. W. H. Preece, F.R.S., chief electrician to the Post Office, to whom, at his request, Mr. Gatehouse showed the belt, has sent him a letter to the effect that so far as he could see from an examination of the appliance, and from the results of the tests, it would be quite impossible for the belt to generate a current of electricity through the body."

Now that article appeared in the ELECTRICAL REVIEW on the 22nd of July; and certain allusions which are contained in the passages which I have read to you from that article, will be more thoroughly appreciated when I tell you that it had been elicited at the trial, that the assistant who acted for the Medical Battery Company at their so-called institute—or one of the assistants—had been, at an earlier period of his career, a furniture salesman. He was called the hernia specialist. Now, gentlemen, another article appeared upon the 19th August in the ELECTRICAL REVIEW, and a third on the 16th September. There are some notices on the sub-

ject which appeared in between; but I am taking the main salient points for the purposes of my opening, and in order to let you see what the circumstances were under which the defendant thought fit to issue this circular describing these criticisms as malicious libels. On the 19th August, at page 215, there appeared this article:—

"Electropathic Belts.—It is evident, from the advertisements now issued by the Medical Battery Company, that its recent action against Mr. Jeffery, in the Bloomsbury County Court, has not resulted quite to the company's advantage. Inducements of all kinds are being held out to influence the inquisitive, the curious, and the unwary, amongst the most recent being the magnanimous offer of the use of the company's experimental room and testing apparatus, free of charge (by appointment) to all physicians and scientists who are unable to obtain such accommodation on their own premises. 'This offer is made so that when asked whether Harness's electropathic belts are scientifically constructed electro-medical appliances, they will be bound to answer yes, and to admit that the mild currents generated by wearing them are of sufficient strength for all ordinary curative purposes.' This is certainly a point with which the medical journals can effectually deal, and we trust that they will lose no time in sounding a warning note to the members of the profession. Judging from one of the letters in our correspondence columns, which Mr. Desmond Fitzgerald has kindly offered us for publication, and which is probably only a sample of others sent to various gentlemen, the president of the Electropathic and Zander Institute is evidently striving his utmost to induce some scientist of standing to associate himself with the company, but whatever opinion a physician—knowing possibly as much about electricity as does the electropathic belt specialist himself—may, in an unguarded moment, give expression to, it is quite unlikely that anybody in the electrical profession will be found to assert that the E.M.F. set up by a disc of zinc and a disc of copper from body moisture will produce any other effect than that to which we testified in our issue of July 22nd. It is, however, only fair to add that the letter dated August 9th, 1892, is pathetic enough to have softened a heart of adamant; so for the welfare of the great British public we trust that other recipients of such letters are made of the same stern stuff as Mr. Fitzgerald."

On the 16th of September the ELECTRICAL REVIEW returned to the charge, and had this paragraph on page 352:—

"Visit to the Electric Belt Establishment. The Oxford Street electric belt establishment has been visited by a representative of the *Pelican*, at Mr. Harness's invitation. It is only right, however, that in describing his visit, he should modestly own that his 'knowledge of electricity is of a very shadowy character;' but yet he is bold enough to say that he left the 'colossal establishment with a very clear understanding as to the methods employed at the Electropathic Institute.' 'The apparatus,' he says, 'struck me as being very complete, and I can well understand that the surprising development of this most surprising establishment must have cost Mr. Harness years of constant labour, and the expenditure of thousands of pounds.' The subject of the efficiency of the belts is judiciously avoided, therefore the visitor's task became very simple, because anyone can talk about buildings, furniture, commercial methods, etc., while the real point at issue is left alone."

Well, gentlemen, whatever the correspondent and representative of the *Pelican*, knowing nothing of electricity, might say with regard to Mr. Harness's establishment, I shall be able, I think, without going into electrical details, by-and-by to satisfy you that these belts are utterly and absolutely useless for the purpose for which money is taken for them. Now there are two other paragraphs contained in this newspaper of the 16th September, at page 353:—

"More about Electric Belts.—A very 'highly coloured' description of the Electropathic Institute appears in *Hearth and Home*, from the pen of some individual writing under the appellation 'Seeing is believing.' We have not space to refer lengthily to the remarks, but when we see it stated that one of Mr. Harness's ordinary electric belts is capable of generating a current sufficient to ring an electric house bell, we must emphatically deny the possibility of such a thing. The representative of *Hearth and Home* was not aware that the bell might have been connected, through the medium of the belt, with another and more powerful battery, and that it was this, and not the electricity from the belt, *per se*, which rang the bell."

That is exactly what took place, gentlemen. A witness will be called before you who will prove to you that by the agency of another battery the bell was rung, which some simple people who contributed to *Hearth and Home* believed was really rung by the electric belt. The battery was under the table.

Mr. GERMAINE: I am somewhat loth to interrupt my learned friend, and he will excuse me for doing so, but in the absence of Sir Edward Clarke, who leads me, who is unfortunately detained at the Old Bailey, I feel it my duty to take an objection at this stage of the opening to the evidence which is foreshadowed by the opening speech of my friend, Mr. Finlay. I think if your Lordship would look at the pleadings in this case, you will see that perhaps my friend, Mr. Finlay, has not quite accurately grasped the issues which are before the jury in this case; because on the pleadings there is an entire absence on the part of the defendants of any justification whatever. The defences which are put in issue here to-day are simply of two kinds—one is the question of privilege, that the communication upon which the action is based is a privileged communication.

The LORD CHIEF JUSTICE: The defendants say that in a newspaper called the ELECTRICAL REVIEW, which said newspaper was circulated for the purpose of sale through certain newspaper vendors, there were published certain articles and printed matter containing accusations of fraud and dishonesty against the defendants in the conduct of their business, and thereby intended to and calculated to injure the defendants in their said reputation as a business company, and to diminish their profits in their said business; and that the defendants *bonâ fide* believing that the said articles and printed matter were libels upon the defendants in their said business, and for the purpose of protecting their said business reputation and business from injury by reason of the circulation of such accusations, and not for the purpose of injuring the plaintiffs, wrote and published to the said newspaper vendors. What is your objection, Mr. Germaine? I do not quite see it.

Mr. GERMAINE: My objection is this: that on the defence as drawn there are two pleas, one of privilege and the other of justification under the circumstances of the case of the writing of the letter, but the libel complained of, in regard to which the innuendos are drawn in the statement of claim, is in no sense justified at all, and, therefore, I submit to your lordship that any question as regards the efficacy, the utility, or the uselessness of the belt is not in issue in this case at all. If we had intended to put it in issue in this case we should have pleaded justification, and been prepared with a mass of evidence upon it.

The LORD CHIEF JUSTICE: I cannot stop it because it goes to damages. I think if Mr. Finlay says it is not the wonderful remedy that it is said to be, he has a right to show that.

Mr. GERMAINE: But I may say there is an action in which justification is pleaded, and in which the whole question of the efficacy of these belts will be decided in a court of law.

The LORD CHIEF JUSTICE: Possibly this action may save that.

Mr. GERMAINE: We are anxiously waiting for my friend to put in his defence in the action, which he studiously avoids doing.

Mr. FINLAY: It is in.

Mr. GERMAINE: It has been struck out by the Divisional Court. Perhaps your Lordship will allow me to take the objection at the close of my friend Mr. Finlay's remarks.

The LORD CHIEF JUSTICE: Very well, I will not stop him.

Mr. FINLAY: Gentlemen, my learned friend has observed that the defence pleaded is that the occasion was a privileged one, and that the defendant's *bona fides* believing that the said articles and printed matter were libels upon the defendants in their business, and for the purpose of protecting their business reputation and business from injury, did what is complained of. I am showing you that the defendants did not and could not believe *bona fide* that these articles were libellous. Now I have called your attention to the notice which appeared in the ELECTRICAL REVIEW of the 16th September. On the same day the defendants sent round the circular which is complained of—it is dated the 16th September—warning all newsvendors not to sell the ELECTRICAL REVIEW on the ground that it contained malicious libels on the defendant company. Now, gentlemen, I need not waste time in pointing out to you the serious nature of the accusations made. If these gentlemen, Mr. Alabaster and Mr. Gatehouse, the managers of the ELECTRICAL REVIEW, were capable of prostituting their position as managers of such a review as that—a scientific review—for the purpose of publishing malicious libels about anyone, they would deserve to be exposed, and they would deserve the contempt of every honest man. That is the statement which the defendants thought fit to make with regard to these gentlemen, whom you will see in the witness box, and to make in a circular sent round wholesale to all newsvendors who are concerned in selling magazines and other periodical literature—regardless of the fact whether the ELECTRICAL REVIEW happened to be sold by those particular newsvendors. It was sent to every newsvendor who, by any possibility, might at any time sell the ELECTRICAL REVIEW. Gentlemen, the result was that the plaintiffs were deluged with applications for indemnities from newsvendors if they were to sell the REVIEW containing such dangerous matter, and one large firm refused to sell the ELECTRICAL REVIEW upon any terms. The writ was issued in the action by the plaintiffs, complaining of this circular, on the 22nd September, and the defence which the defendant set up for the purpose of justifying so serious an attack upon the personal character and professional honour of Mr. Alabaster and Mr. Gatehouse is, that the defendant was acting in honest self-defence. Now, gentlemen, for the purpose of appreciating the honesty of that defence, as raised by this Medical Battery Company, I shall have to call your attention to the character of the proceedings that go on at that institute, and the character of the wares which are there put upon an unwary public. Gentlemen, the first class of cases to which I direct your attention is this. The efficacy of any treatment, whether it be by electropathic belts or by any other means which does not belong to the category of ascertained and well recognised remedies, is always largest in the class of diseases known as nervous diseases, or diseases partaking more or less of that element. It is there that vendors of such instruments find their most ready market. But there are certain diseases in which by no possibility could any honest man have for one moment supposed that the use of an electropathic belt could do any good whatever. Now I will give you a few instances of cases which will be proved before you with regard to the sale of these electropathic belts at the defendants' institute, to persons who by no possibility could be benefitted by them. One is the case of the clerk who was sued by the defendants in the Bloomsbury County Court. This poor man was suffering from hernia. Well, you know, gentlemen, the nature of hernia or rupture. It is a protrusion of the bowels—the bowel coming down through the openings in the wall by which the intestines are enclosed—a very troublesome malady of a distinctly physical nature. Gentlemen, is it not monstrous that any one, particularly a poor fellow in quest of health, and ready to pay anything he could scrape together if he could only help to get health again; is it not monstrous that an electropathic belt at five guineas should have been put upon a clerk suffering from an ailment like hernia? Of course, gentlemen, by no possibility could this belt do any good in the case of such an ailment as hernia. As a matter of fact it did him a great deal of harm, as was proved at the Bloomsbury County Court, and will be proved before you again, if my friends put me to the proof of it—pushing the protruding bowel down. I shall ask you when you look at this case, and at others, to say what you think of such an establishment where such things are possible and are practised. In another case there was a lady—I will not give her name at present; she will, I believe, be called before you herself—who was suffering from a very formidable disorder, the result of disease taking place in the membranes, I believe, of the spinal cord, known as locomotor ataxy, an incurable disease, practically. Gentlemen, this lady unfortunately went to the institute, and she paid, on the advice of the experts, so-called, put forward by the defendant, for shocks and what were called electric pills, the sum of one hundred guineas. Gentlemen, there was another case of a man who was suffering from hernia and from undescended testicles. You may not be aware that the testicles descend from the internal part of the abdomen before birth, and that in some cases after birth the testicles still remain undescended. That, of course, is a natural physical ailment, for which surgical relief may be of service, as it may be in

case of hernia. Would you believe it, this poor fellow, having gone to the institute, was induced to pay the sum of thirty guineas out of fifty guineas which was asked of him, for electrical treatment—absolutely and utterly useless shocks administered in a case of that kind—a purely physical ailment which was ultimately, I believe, set right by a surgeon.

Mr. GERMAINE: What was his name?

Mr. FINLAY: I will tell you directly. I would rather not mention the name at present.

Mr. GERMAINE: You are going to call him?

Mr. FINLAY: Yes, he will be called. Then another man was suffering from a weak heart. Well, he went to the defendants and explained that he was suffering from a weak heart, and he was advised to buy a ten or fifteen guinea belt to wear by way of helping him over this infirmity. He bought a five guinea belt—he could not rise to the ten or fifteen guineas—he put on the five guinea belt, and a shock was administered to him from a battery and he was told to button his clothes over the belt and go away. That man also you will see, gentlemen. In addition to the sale of the belts the defendants sell what they call an electric corset. They describe it as being magnetic in its properties, and this corset is a corset which is recommended to ladies. A lady, I believe, will be called before you who bought one of these magnetic corsets for indigestion, from which she was suffering, and you will hear what took place when she went to the institute, where the great endeavour made was to induce her to buy as expensive a one as possible. Now, gentlemen, the pamphlet issued by the defendant's company contains, I think, the most formidable list of disorders which I daresay you have ever seen. It is entitled "The Medical Uses of Electricity: a Treatise on the 'Electropathic' Method of Curing Disease. By Mr. C. B. Harness, Consulting Medical Electrician, President of the British Association of Medical Electricians, Member of the National Eclectic Medical Association." I do not know what the Eclectic Medical Association is, something very exclusive I should think if Mr. Harness is a member of it. "Member of Honour, with Cross of Merit, of the Belgian National Society of the Red Cross, &c., &c. Published by the Medical Battery Company, Limited." Then follows a "Treatise on Electricity" in general, and "Electricity Defined," and so on. Then you go on to "Galvanic Electricity" and "Faradic Electricity"; "The Curative Powers of Electricity." Then you see the diseases that may be operated upon by electricity. They are "Diseases of the digestive organs, dyspepsia or indigestion." There is a paragraph devoted to each of these, "constipation, flatulence, jaundice, pyrosis, colic." Then you come to the "treatment," which is in leaded type, and the treatment is this:—"My electropathic method of directing mild currents of electricity centrally to the system, in a convenient and agreeable manner, by wearing an electropathic belt of good power, achieves this in a safe and simple way, unsurpassed by any other remedial agent, and may in all cases be relied upon to effect a prompt and permanent cure." Then we come to "Diseases of the respiratory organs," "asthma, bronchitis, pleurisy, pleurodynia, phthisis, or consumption." Then again you have got "Treatment," in leaded type, "in diseases of the respiratory organs. I attach great importance to curative and protective measures, and in all the disorders alluded to in this section an Electropathic Lung Invigorator—an appliance constructed to be worn over the whole of the upper portion of the body above the waist, thus completely covering the lungs—should be used, as apart from the curative influences it exerts upon the entire respiratory tract, it shields such patients from liability to contraction of cold, to which they are, generally, extremely susceptible." If that does any good, gentlemen, it must be the good that a flannel shirt would do. "Where there is any marked debility or lack of tone an electropathic belt will do great good in recuperating the vitality of the system. Stomach drugging for respiratory troubles is absurd, and should be superseded by the inhalation of suitable medicaments, the inspiration of which conveys their curative properties direct to the diseased parts. As a convenient inhaler my patent Ammoniaphone, fully described on pages 78–9, is, for simplicity of construction and efficiency of action, the most perfect instrument ever yet devised." Then we come to "Functional organic disorders, Bright's disease, cystitis, an inflammatory affection of the bladder; diabetes, diarrhœa," which, he says, "results from hyper-activity of the bowels," "dysentery, gastralgia, a recurrent neuralgic state affecting the stomach or bowels." Then there is "Treatment of these diseases by the electropathic method depends for success upon its infallible efficacy in restoring normal functional action of the various organs involved, in removing morbid inflammatory conditions, in imparting internal tone, and in relieving pain. Most satisfactory reports daily come to hand from patients at home and abroad respecting the benefits derived from the electropathic appliances. When advice is desired each case is dealt with according to the particular symptoms it presents"—that is by the experts at the institute! Then we come to "Diseases of the nervous system." There is a paragraph on "Nervous exhaustion, flushing of the face, chorea or Saint Vitus' dance, epilepsy, falling sickness, sleeplessness"—insomnia, as Mr. Harness learnedly calls it—"hypochondriasis, vertigo or giddiness, paralysis, hemiplegia, paraplegia"—the name given to paralysis of the lower half of the body; "locomotor ataxy," the disease from which that poor lady to whom I referred was suffering; "loco-paralysis, atrophy, cephalagia or headache, brow-ague or hemicrania, neuralgia, sciatica, tic-doloreux or facial neuralgia." Then we come to "Treatment. The diseases mentioned in this section are divisible into three classes, (1) those in which the equilibrium of the nervous system is overthrown, as in epilepsy; (2) those involving loss of movement, and sometimes sensation, in which there is a partial or total failure of volitional stimulus to the normal functions of the sensory and motor nerves and muscles, as in paralysis; (3) those characterised by intense pain in the nerves themselves, as in neuralgia and sciatica. In the first-named a general direction of currents centrally to the body and electrisation to the spine, by wearing an Electropathic Belt and Spine Band of good power, is always attended with the desired curative results; in the second these same methods with local administrations in severe cases of battery currents to the affected parts and limbs; while, in the third, the racking torture of neuralgic pain is infallibly cured by the constant current administered constitutionally in a mild form by an electropathic belt, and supplemented in acute cases by more powerful localised applications from a battery, which brings about a change in the condition of the nerves. Nervous disorders are extremely varied in their origin and character, and in any serious case advice should be sought as to its proper treatment."—Advice at the institute of course! Then we come, gentlemen, to the delicate subject of "Diseases of Men." I will not read the passage. A list of disorders is given, and Mr. Harness says: "Without going further into particulars"—he has to some extent gone into them—"it may be said without exaggeration that the electropathic treatment is absolutely certain, properly directed, to effect a cure." Gentlemen, you will see that page for yourselves, and you will be able to judge how far it was *bona fide*, and how far it was likely to bring to that institute a class of patients who would be ready to pour money into its coffers. Then follows a long treatise on "Diseases of Women." They are enumerated, but I will not read them out. There is a long list of disorders peculiarly affecting women, including a number of special disorders, including even uterine tumours and sterility or barrenness. Then there is "Treatment of the actual disorders of the uterine system and others which are sympathetically dependent thereon is uniformly successful when proper remedies embraced in the repertoire of my electropathic method are adopted. Every case whether advised upon personally or by correspondence is regarded as strictly confidential, and ladies need not hesitate in consulting me upon maladies of this nature, which, when neglected through mistaken motives of delicacy cause an infinity of silent suffering. In prolapsus of the womb"—a purely physical infirmity: the falling down of the womb,—"a very common occurrence, the use of my Electropathic Abdominal Belts, combined in serious cases of Procidentia"—that is Mr. Harness's learned description of falling forward—"with that of the Natural Uterine Supporter (see p. 80) constitutes mechanical and curative treatment, which is sure to be successful as the mild continuous currents impart internal tone and strength to the relaxed ligaments, while my Natural Uterine Supporter is the only appliance of the kind which gives the needful support without causing irritation and weakness, as it can be dispensed with on retiring to rest, when in recumbency it is not required. In the other disorders enumerated the Electropathic Belt and Spine Appliances are invaluable, but for full information as to cure ladies are referred to my treatise on 'Electrisation' as a remedy for the diseases of women (post free on application) concerning which Dr. Anna Kingsford, M.D.,—one of their own sex—writes: 'This little pamphlet is written with considerable skill and ingenuity, the object being to refer sufferers from the various complaints enumerated in it to electrical appliances for treatment. Incidentally a great deal of wise advice is given, and much instruction on physiological details afforded,'" and so on. Then Mr. Harness passes to "Diseases of the blood, gout, rheumatic gout, acute rheumatism, chronic rheumatism, muscular rheumatism, lumbago." I will not read the whole of the passage to you. "Treatment," which is again in leaded type. He begins by saying: "Disorders arising from a diseased condition of the blood are especially amenable to the electropathic method." Then he says: "The Electropathic Belt and Spine Appliances are promptly beneficial," and he claims for them that they have "a marked effect in increasing the vital properties of the life-sustaining fluid." Then there is "Miscellaneous diseases. Corpulence, its causes, consequences and cure, post-free on application; piles, writer's cramp. Then he refers to his treatment of corpulence, and then having run through his list of disorders, he goes on to "Medical Authorities. The subjoined list gives the names of contemporary physicians and medical men who have advocated electrical treatment for the cure of disease:—Sir Charles Locock, Sir Henry Holland, Sir William Fergusson, Physcians to Her Majesty the Queen." Now, I call your attention to the way in which this is put forward. Electrical treatment, by adminstering shocks, may, in a certain limited class of cases, do good; but what a thing it is that you should have, in a pamphlet of this kind, intended to be circulated broadcast, the names of these three gentlemen: Sir Charles Locock, Sir Henry Holland and Sir William Fergusson, put forward in such a way that the unwary reader is apt to suppose that there is a recommendation of Mr. Harness's method of treatment with the electropathic belt. I will not occupy your time further on that pamphlet, but submit to you, gentlemen, that the mere reading of that pamphlet and the way in which it is put forward gives one an insight into what is the real character of this establishment, and what were the real motives of Mr. Harness when he instructed his solicitor to endeavour to put down criticism of his institute by stigmatising these attacks as malicious libels and stigmatising them as malicious libels in the quarters in which such an attack was most likely to do harm. I will not weary you by going into the details of other cases which will be proved, but I desire to say a few words to you with reference to the character of these belts, and to the question whether any human being having the most elementary knowledge of electricity could, by any possibility, suppose that these belts, as they were commonly sold at the Electropathic Institute, would generate any electricity at all. Now, here is one of the belts. It contains discs of zinc and discs of copper. In some cases they are mixed up as they are here, on the one side, and on the other side; in other cases they have all the copper on one side and all the zinc

on the other. Here you have the zinc all on one side and the copper on the other. Now, gentlemen, I will prove to you that these belts have been commonly sold at the Electropathic Institute without any external connection whatever. Now, the importance of that is this: An extremely minute quantity of electricity might be generated, and would be generated, if plates of zinc and copper were worn upon the body exposed to the moisture of the skin, if the zinc and the copper were connected up externally. You may be aware, gentlemen, or some of you may be aware, that electricity is a matter which has attracted a great deal of attention lately, that one method of generating electricity is by putting a plate of zinc and a plate of copper into what is called an electrolyte, that is to say, some fluid which will affect the zinc and the copper, and will occasion a chemical action and a transference from one plate to the other, with the result that a current is generated if the zinc and the copper are externally connected; that is to say, if you have a metallic connection between the zinc and the copper; but if you have not got that metallic connection there will be absolutely no current. Now, gentlemen, I shall call before you case after case in which these belts have been sold at this institute, and sold for as much as ten guineas or more, in which the unhappy patient got a belt containing zinc and copper discs, was directed to wear this belt and was told that it would generate electricity. Now, gentlemen, evidence of distinguished electricians will be called before you, who will state what I apprehend hardly anyone will venture to deny, that, under such circumstances, it is absolutely impossible that there should be any current of electricity whatever. Now, gentlemen, this is not the only action which has lately been in court. There was another action which was brought by a Dr. Tibbits the other day, in the course of which it was proved, and I have no doubt will be proved again in the course of this case, that Mr. Harness had provided the costs of the proceedings. The proceedings were brought by Dr. Tibbits in respect of some remarks which appeared in the ELECTRICAL REVIEW with regard to Dr. Tibbits's commendation of these belts. Now, gentlemen, since these proceedings, and since the matter has come forward, the defendant has taken to inserting in his advertisement notices that the discs of zinc and copper ought to be coupled up; but I think that I shall be able to establish before you beyond all doubt that the defendant has been in the habit of selling these belts without the external connection; and, indeed, it will be shown to you that the sort of hole or socket which is shown on the side of these belts is a socket which was well enough adapted for sending a current from a battery if the wires from the battery were inserted into these sockets, but which were not adapted for a connecting wire. The caution, gentlemen, which Mr. Harness has recently sent out as to the necessity of connecting these discs of zinc and copper for the purpose of generating a current of electricity, will not relieve him from the stigma of the fact that belts were sold at his institute without any such connection; without any proper provision for it, and without any wire being given to the patient by which the connection should be effected, and therefore under circumstances which made the generation of any electrical current an absolute physical impossibility. But, gentlemen, even assuming that if that external connection were made, as Mr. Harness has now recently been telling people it should be made, the current generated by such an electropathic belt with external connection would be a current of excessive feebleness. It is almost impossible to characterize the minuteness of the current which would be generated. It is a very great deal below the smallest current which for medical purposes would be of the slightest use; and moreover of that very small current, by far the greater part would return, not through the body at all, for the resistance of the skin is very considerable, but through the perspiration on the surface of the body, and the webbing of the belt which is worn round the body. Gentlemen, you will hear upon this question the evidence of some men thoroughly competent to express an opinion, and I shall ask you in dealing with the question of the *bona fides* of this attack made by the defendant upon the plaintiff, to bear in mind these two facts: first, that the defendant was in the habit of selling belts without the external connection, when the pretence of electricity being generated was absolutely unfounded; and, secondly, that even if the external connection were made, the current of electricity generated would be so excessively feeble, that, for all curative purposes, it would be absolutely useless; and of that current, the greater part would not return through the body at all, but through the webbing of the belt and through the perspiration on the surface of the body. I believe that I am not exaggerating when I say that you would get more electricity out of a pin and a needle dipped in ink, than you would out of one of these electropathic belts even if properly connected. Now, gentlemen, there is a very short matter to which I wish to direct your attention as affording a measure of the defendant's *bona fides* in this matter, when he asserted that these criticisms were malicious libels upon him and upon his institute; and it is this, the nature of the experiments and commendations which he put forward for the purpose of recommending his treatment. I do not know whether we shall see Dr. Tibbits in the witness box on behalf of the defendants. He was the plaintiff in the action brought the other day to which I have referred; but the defendant himself, Mr. Harness, published commendations of this electropathic treatment which he had got from Dr. Tibbits, and one point which I am going to direct your attention to is this. In this pamphlet of Dr. Tibbits, issued by the defendant, it is represented that these discs of copper and zinc may be coupled up, as it is called, for intensity. Gentlemen, a word of explanation is perhaps wanted upon that subject. You may be aware or, at least, it will be explained to you by competent electricians if you are not aware, that if you have a number of discs of zinc and discs of copper, if you connect together all the copper discs and then connect together all the zinc discs, and have them in the electrolyte and effect the necessary connection between the two groups, you couple them up for what is called quantity; that is, the effect is the same as if the size of the copper discs were multiplied by the number of copper discs which you have connected together, and as if the size of the zinc discs were multiplied by the number of zinc discs which you have connected together. That is what is called coupling up for quantity. On the other hand, you may desire to couple up for intensity, and in that case you have got so many couples of zinc and copper in separate cells with separate electrolytes—for that is absolutely necessary; and then you get the intensity in volts — the voltage is increased the more cells you couple up in that way for intensity. Now, gentlemen, it is almost incredible to anyone possessing a knowledge even of the rudiments of electricity, but in this pamphlet issued by Mr. Harness it is represented that "either quantity or intensity can be obtained." I am reading from the top of page 6 of Dr. Tibbits's pamphlet. And in another passage at page 7 he says (I am going to refer to the experiment presently), "I applied to it a current equivalent to that derived from a 'Harness Electropathic Belt,' in which the elements are connected for intensity." But, gentlemen, when you connect the elements for intensity it is absolutely necessary that you should have separate cells and separate electrolytes in order that you may get the aggregate, and that the voltage may be increased. It is physically impossible to couple up these zinc and copper plates of these electropathic belts for intensity, because they are all in the same electrolyte, such as it is—such a very feeble electrolyte as the perspiration on the surface of the human body and the webbing of the belt saturated with that perspiration. There is no separation. There are no separate cells, and to couple up for intensity is a physical impossibility. Now, gentlemen, I do ask you what you think of a man who poses before the public as an authority on medical electricity, who procures to be written for him a pamphlet making the representation that these belts can be coupled up for intensity, and who distributes such a pamphlet to an unwary public, when every man who knows anything about the subject says it is a physical and an utter and absolute impossibility, that the thing cannot be done. But, gentlemen, I have not quite done with Dr. Tibbits's pamphlet, and if we have the pleasure of seeing either Mr. Harness or Dr. Tibbits we shall be enlightened as to the circumstances under which this pamphlet was written. This pamphlet of Dr. Tibbits's contained certain experiments. Now, gentlemen, these experiments really should find their proper place in *Punch* or some other comic periodical. The first experiment is this:—

"With the above apparatus I conducted the following experiments:—(1) Slightly moistened, all the above gave considerable deflections of a milliampere galvanometer. (2) When worn upon the body, and set in action by the natural perspiration, the wires from the poles being connected with a galvanometer, gave deflections. (3) The apparatus being worn upon the body, the positive pole was connected with Lord Kelvin's reflecting galvanometer and a platinum needle insulated to within 1-16th of an inch of its point, and also connected with the galvanometer, was inserted 1-3rd of an inch perpendicularly through the skin, and one inch from the negative pole, the distance between the two poles being six inches; and the intervening skin being thoroughly dry, *and powdered with starch powder so as to render it as much of an insulator as possible.* The beam of light at once travelled several degrees. The needle was then re-inserted exactly midway between the two poles, and a smaller deflection was obtained."

Then you will see there is an engraving. You have got the positive pole and the negative pole; then you have got what represents the surface of the skin, and here is the platinum needle marked E, which is supposed to be inserted through the skin. Gentlemen, the deflection of the galvanometer observed on that experiment would indicate, as will be proved before you, a very slight current set up between the platinum pin and the copper disc. It would not be a current between the copper and the zinc at all. It was a current set up between the platinum needle and one of the discs itself. The way of testing a current of that kind is, as everybody knows who has gone into the subject, that you make the circuit at the intervening point; you do not insert merely one wire connected with the galvanometer, but you insert two wires through which you are able to ascertain the strength of the current. Here the current set up was a current between the platinum needle and one of the discs, and it passed round through the external connection effected in this way with the galvanometer and the wire passing up to the platinum needle. Then, gentlemen, I will go on reading this passage, and lead you up to another most remarkable experiment with a skinned rabbit.

'The contention of the opponents of the belt is that the current passes from A to B across the surface of the skin, and does *not* penetrate it. If, therefore, a deflection of Lord Kelvin's galvanometer, was shown (*under the conditions described*) by a current passing between the positive pole A, and the insulated needle E, that current must have been derived from the interception by the needle E of the current circulating *beneath the skin* from the pole A to the pole B, proving absolutely that the current *penetrates the skin* at the poles A and B."

It proved absolutely nothing of the kind. The experiment is mere nonsense, as will be proved to you, over and over again, by electricians:

"To an objection which has been made that my assertion *that either quantity or intensity can be obtained* is false, I reply that the 'WEBBING' of the belt is to a certain extent an insulator, and, therefore, when the elements are coupled for '*intensity*,' there is no possible doubt that a measurable amount of intensity is obtained."

Gentlemen, that is the most extraordinary thing to put forward, that the webbing of the belt is, to a certain extent, an insulator. Now, gentlemen, the discs are fastened to this webbing, and the belt and the webbing of the belt, when moistened by the perspiration of the body, so far from being an insulator, is an electrolyte. Instead of having the different plates of copper and zinc in different cells, you have got them all in the same cell and in the same electrolyte.

"I would observe that throughout my report, I have carefully guarded myself against any opinion as to 'dosage' of electricity. Homœopathic physicians believe in small doses. One of them, now under my treatment, declares that with twenty drops of whiskey in a wineglass of water he is feverish, whereas five drops act as a tonic to him. The question of dosage not being the question discussed by me, I

say emphatically that the deflection obtained by any galvanometer is a proof that these 'belts' generate electricity, which was the question I investigated. As a supplementary experiment to experiment 3, I have experimented as follows. Experiment 4.—Having procured a live rabbit, I had it killed, and at once skinned, so that the muscles, etc., should be good conductors."

Here is your scientific man! It is not vivisection exactly; but it is a live rabbit which he procured. He had it killed and then he skins it, and here is your science applied to medical electricity!

"Having procured a live rabbit, I had it killed, and at once skinned, so that the muscles, etc., should be good conductors. Within five minutes of its death, I applied to it a current equivalent to that derived from a 'Harness electropathic belt,' in which the elements are connected for intensity."

What that current is, gentlemen, we do not know, inasmuch as it is impossible to connect the Harness electropathic belt for intensity; and Dr. Tibbits and Mr. Harness who issue these are not good enough to inform us how he applied the current, and from what apparatus.

"The following diagram will explain the matter."

I do not know whether your eyes are good enough to see the unfortunate rabbit in a skinned condition. *There* is the band of india-rubber which he states he put to discharge the functions of the absent skin; then the galvanometer is inserted with needles, at *these* two points which I indicate with my finger, through the india-rubber into the muscles of the lately live rabbit. Then he goes on:—

"The current passes from the positive to the negative pole. The thin sheet of gutta-percha A to B is an insulator to represent the epidermis. Two needles C and D, insulated as in experiment 3, and connected with Lord Kelvin's galvanometer E, were inserted through the insulating gutta-percha, and a deflection was obtained."

Gentlemen, what is the good of the gutta-percha if you put needles through it? For what purpose was this experiment put forward except to gull the unwary? The whole thing is mere nonsense.

"It will be observed in this experiment, as distinguished from experiment 3, the needles were entirely separate from the belt, and that they tap the current, as was often done by the Germans when Marshal Bazaine was besieged in Metz, and when the Germans intercepted his underground telegraph wires."

All I can say is, that the Germans got more by intercepting those currents than anyone would ever get by trying to intercept the current from an electropathic belt.

"To make assurance doubly sure I have repeated the above experiment upon my own body, and I have obtained similar results."

Perhaps Dr. Tibbits in due time may be able to explain that mysterious passage to us. Now, gentlemen, I am not going further to occupy your time in opening this case. What we complain of is this—a most serious aspersion upon the professional honour of Mr. Gatehouse and Mr. Alabaster. The defendant says he did it in honest self-defence. I submit that such a publication to these newsvendors could not possibly be a privileged occasion, and I further submit—and this will be a question for you—that he did not do it in honest self-defence. We shall be able to lay before you a mass of materials to satisfy you beyond all doubt that the defendant was seeking to stifle what he knew or suspected was a well-deserved criticism by endeavouring to stigmatize it as malicious libels.

[*Adjourned for a short time.*]

Mr. ALBERT ARTHUR HARSTON, sworn, examined by Mr. BANKES:

You carry on business as a law stationer I believe?—Yes.

At 39, Hatton Garden?—No. 7, High Holborn,

I believe that you are the law stationer who does business for Mr. Fleet, the solicitor for the Medical Battery Company?—Yes.

Will you kindly take that circular in your hand, and tell me if that was prepared by you [handing same to witness]?—No.

Was it lithographed in your office?—No.

Have you ever seen it before to-day?—I do not know that I have. I have seen one like that before. I believe it is in one of the counsel's briefs.

It was prepared in your office?—No.

And you know nothing of it?—No. Nothing whatever.

Mr. WILLIAM TIMBRELL, sworn, examined by Mr. FINLAY.

You are a newsagent I think?—Yes.

Residing at 360, Commercial Road?—Yes

Did you receive a copy of this circular signed by Mr. Fleet?—Yes.

Is that the one which you actually received [handing circular to witness]. What did you do with the copy you got?—I handed it over to the solicitors.

Are you able to say whether that is it? Your name is written on that in pencil. That has been done by Mr. Lickfold I am told.—Yes; that is not my writing.

Are you able to say whether this is, or is not, the copy which you got?—Yes; this is the copy which I got.

As a matter of fact had you ever sold the ELECTRICAL REVIEW?—No.

Was that received by you by post?—By post.

Cross-examined by Sir EDWARD CLARKE: You never had sold it?—I had sold *Science Siftings*.

Had you ever sold the ELECTRICAL REVIEW?—No.

Have you ever sold it since?—No.

Mr. CHARLES JAMES CATLING, sworn, examined by Mr. FINLAY.

You are a newsagent, I think, at 308, Caledonian Road, Islington?—Yes.

Did you receive a copy of this circular sent by Mr. Fleet?—Yes.

By post?—By post.

Have you ever sold the ELECTRICAL REVIEW before?—Previous to the letter.

You had?—Yes.

And what have you done since?—I have not sold any at all since. When they have been brought round to me I have put them on one side, and not sold them at all, when they were delivered to me.

You would not take them?—I would not take them.

Cross-examined by Sir EDWARD CLARKE: How many had you sold before?—Well; not any quantity. They may have left perhaps half-a-dozen copies a week.

How many have you sold?—I cannot say. They have been delivered to the man on his calling for them the following week, and I cannot remember. I may have sold two or three copies.

Do you say you ever sold a dozen copies in your life?—No; I cannot say that.

They brought them one week and left them, and they called for them the next week?—That was a matter of business

That was what generally happened. You gave back the copies they had left?—Yes; unsold copies.

Re-examined by Mr. FINLAY: Did you try to sell them afterwards?—No.

Why was it?—I continued putting them on one side, and that brought up the publisher to know the why and wherefore I did not sell them.

Why did not you sell them?—Merely on account of receiving that lawyer's letter—wholly on that account.

Mr. JOHN HUGHES, sworn, examined by Mr. FINLAY.

You are a newsagent?—I am.

Where do you carry on business?—At 761, Commercial Road.

Did you receive this circular from Mr. Fleet?—I did.

By post?—Yes.

Had you ever sold the ELECTRICAL REVIEW?—One or two copies I think, as far as I can recollect.

Cross-examined by Sir EDWARD CLARKE: As far as you can recollect, one or two copies?—One or two copies.

How long before you received this circular?—Well, about a month or two I should think. They were left on sale.

You think you had sold one or two?—One or two.

What was the price of the ELECTRICAL REVIEW?—Sixpence.

I am afraid you do not know very much about it. It is fourpence.—No; they were left on sale, and I do not recollect. There were only one or two copies sold.

Sir EDWARD CLARKE: The published price was fourpence, not sixpence.

Mr. ARTHUR JOHN GOTTSCHALK, sworn, examined by Mr. FINLAY.

Are you in the employ of W. H. Smith & Sons?—I am.

What is your business there?—I order the supplies of papers and check all accounts, and keep the accounts.

They are, of course, newsagents?—Yes.

Did Messrs. W. H. Smith & Sons receive a copy of this circular from Mr. Fleet?—They did.

By post?—I presume by post, I do not open the letters.

Had you previously sold the ELECTRICAL REVIEW?—Yes.

Largely?—To the extent I should say of about fifteen quires per week.

How many copies does that mean?—About 405 copies. I may mention that is the nett sale.

What have you done since the circular was received by you?—We have received a letter from the solicitors saying that they would relieve us of all responsibility if we continued the sale of it.

From the solicitors of the ELECTRICAL REVIEW?—Yes.

What did you do on that?—Well, we continued selling it, and we do sell it.

Have you got the undertaking which you got from them?—I have all the correspondence here if you would like to look at it [producing same].

Perhaps you know it better than I do. Can you refer to the material letters: there seems to be a good number of them. You asked for certain terms before you would go on with the sale, I understand?—Exactly.

Is this your letter?

Sir EDWARD CLARKE: I do not see how this is evidence, but of course it would arise on my cross-examination.

Mr. FINLAY: You required, I think, an indemnity?—Exactly so.

And an assurance that there should be no matter which could be justly characterised as libellous, and an indemnity against any proceedings if you went on selling?—Yes.

And that you got from Messrs. Lewis and Lewis?—No, we got it from the ELECTRICAL REVIEW people.

And you went on selling?—We did.

Cross-examined by Sir EDWARD CLARKE: You sold as many afterwards as you did before?—Yes, I did not see any difference in the sale of the paper.

Mr. FINLAY: On that indemnity?—On that indemnity.

Mr. FINLAY: I do not know how far we should pursue this. We have a good many witnesses. Our instructions are that this has been circulated broadcast, and sent to a very large proportion of the newsagents in the kingdom. We are calling of course a certain number with the view of showing it. I do not know whether my friend can shorten it by admitting the number that was sent out. We tried to shorten it by calling that first witness, but he proved that we had got hold of the wrong man.

The LORD CHIEF JUSTICE: You see you have called W. H. Smith and Sons. I suppose they are the biggest newsagents?

Mr. FINLAY: Yes, my Lord.

The LORD CHIEF JUSTICE: That is a substantial thing. Do I understand you, Sir Edward, to correct sixpence into fourpence?

Sir EDWARD CLARKE: I believe fourpence was the price.

The LORD CHIEF JUSTICE: The man said sixpence. You corrected him, I thought.

Sir EDWARD CLARKE: Yes, I believe that is so. He did not remember.

Mr. FINLAY: The object of this evidence has been to prove the

extensive circulation of this circular. It was sent to a number of people who had never even sold the ELECTRICAL REVIEW, on the mere chance that they might.

The LORD CHIEF JUSTICE: So I understand.

Mr. FINLAY: I don't know how far we ought to prosecute this evidence.

Sir EDWARD CLARKE: My friend is trying to prove damages, I understand.

Mr. FINLAY: We will call one or two more. My point, of course, is the very extensive character of the circulation.

The LORD CHIEF JUSTICE: Yes.

Sir EDWARD CLARKE: The question of the circulation would not matter if it did not cause damage.

The LORD CHIEF JUSTICE: Have you administered interrogatories?

Mr. BANKES: No, we have not.

The LORD CHIEF JUSTICE: I thought you might, perhaps, have got out by the interrogatories how many circulars they issued.

Mr. BANKES: Yes, we should have put that interrogatory if we had administered them.

The LORD CHIEF JUSTICE: You may take it, subject to what Sir Edward Clarke says, that a letter of this kind sent by a responsible solicitor, and circulated widely, would be certain to affect the circulation, but how much or how little, it is very difficult, of course, to say exactly.

Sir EDWARD CLARKE: I presume there are other persons who can prove how much the circulation of the paper was affected, if at all. I cannot relieve my friend from proving his damage.

Mr. BANKES: I am not sure that we can show that the circulation actually decreased; for this reason, that the paper was getting more prominent, and, therefore, for other reasons, probably greater numbers were being sold.

The LORD CHIEF JUSTICE: You have proved that you have had to give an indemnity to Smith and Sons. You can prove that you gave indemnities to other people.

Mr. BANKES: Yes, we can prove that.

The LORD CHIEF JUSTICE: That, of course, is a serious damage to you.

Mr. BANKES: Very well. We will examine another witness.

Mr. THOMAS CHISMAN, sworn, examined by Mr. BANKES.

I believe you carry on business at 95, Kennington Lane, as a newsagent?—Yes.

Did you receive the circular signed by Mr. Fleet?—Yes.

By post?—Yes.

It is a lithographed circular, is it not?—Yes.

Had you, up to that time, sold the ELECTRICAL REVIEW?—When it was ordered.

About how many copies had you sold before this?—I cannot say—very few—now and again.

Have you sold any since?—No, I have not sold one since. I had lots of orders afterwards.

And what have you done?—Refused to execute those orders in the face of this letter.

Cross-examined by Sir EDWARD CLARKE: How long before you got that letter had you sold those copies?—I sold one, now and again, probably about—well, I might not have sold more than one a year; or two. I cannot say exactly.

You know best. Some little time after this circular do you say there was more demand for the paper?—Yes.

You see the paper from time to time?—Yes, I see it sometimes. I see it on the wholesaler's table.

Did you happen to notice that this very circular was reprinted in the paper?—No, I did not notice that.

Mr. W. H. JONES, sworn, examined by Mr. BANKES.

I think you carry on business at 179, St. Leonard's Road, Poplar, as a newsagent?—Yes.

Did you receive the circular?—Yes.

By post?—By post.

Had you been in the habit previously to that time of selling the ELECTRICAL REVIEW?—Yes.

Have you done so since the receipt of the circular?—Not since.

Why not?—Because I was afraid of proceedings being taken against me.

Cross-examined by Sir EDWARD CLARKE: What did you do with the circular?—It was put on one side, and one of the children got hold of it and tore it into pieces.

How many copies of this ELECTRICAL REVIEW had you been in the habit of selling before?—Selling one for certain every week for some months: a standing order.

To an old customer?—To a customer.

Would not you supply him afterwards?—I did not supply him afterwards.

You did not supply even him?—Not even him.

Do you know whether he got his ELECTRICAL REVIEW somewhere else?—No, I do not; I did not ask him.

Mr. BARWELL was called, but did not answer.

Mr. PHILLIP HENRY TOURLE, sworn, examined by Mr. BANKES:

I believe that you are in the employ of Messrs. Simpkin, Marshall & Kent, of 23, Paternoster Row?—Simpkin, Marshall, Hamilton, Kent & Co., Limited, is the correct style.

They carry on business as publishers and newsagents?—Yes.

Your firm is in the habit of selling the ELECTRICAL REVIEW?—Yes.

Did you receive a copy of the lithographed circular?—We received two copies.

On the same day?—I believe on the same day. I think they were addressed to different establishments. We have three establishments.

And in consequence of that did the firm refuse to sell any more?—We at once stopped sending them to our different customers.

Were you requested to go on selling them by the proprietors of the ELECTRICAL REVIEW?—We received a letter from the proprietors on the 17th of September, 1892, indemnifying us against any damages or costs, and on the receipt of that letter we resumed the sale.

You would not do it without that indemnity?—Certainly not.

Did you sell any considerable quantity of them?—I do not know what the exact number was.

About how many?—I cannot say.

Cross-examined by Sir EDWARD CLARKE: Cannot you tell me whether it was half a dozen a week or twenty a week, or a hundred a week?—No, I cannot. I do not have anything to do with that personally.

Of course there is somebody at your place who could tell how many were sold before this date, and how many after?—I should say so.

Will you allow me to see the letter which you say you had dated the 17th, or which you received on the 17th?—From Messrs. Alabaster, Gatehouse & Co.

Yes.—That is it [handing same to learned counsel].

I do not see from that whether that was in answer to any letter from you. Do you know anything about that? You only received this circular upon the 17th, I think?—The circular is dated the 16th. I do not know what date it was received.

What day did you receive it?—That I do not know.

Are you sure you received it before you received that letter?—I am sure we did, because we stopped the sale of it.

But the circular was dated the 16th. On what day did you get it?—That I do not know.

Was it as early as the 17th?—I should say so.

Do you undertake to say so?—We certainly got it before we got that letter.

Have you got the envelope that the circular came in?—No, I have not.

Or the envelope that the letter came in?—No, I have not.

Sir EDWARD CLARKE: That is dated the 17th.

Re-examined by Mr. BANKES: Just look at that letter. Are you not under a mistake as to the date on which you received it? Is that the letter from the secretary of your firm to Messrs. Alabaster, Gatehouse & Co.?

Sir EDWARD CLARKE: What is the date of it?

Mr. BANKES: The 23rd.—Witness: I have not seen it before. It is unmistakably from us.

That states that on the 23rd you had not received the indemnity as promised?—Well, it is possible the indemnity may have gone to the other house.

Sir EDWARD CLARKE: I think you will see that the indemnity has no specific relation to any circular mentioned in it.

The LORD CHIEF JUSTICE: You must find something to make these letters admissible. We had better hear the letter. The letter, which is dated the 17th, is this:

"On the advice of Messrs. Lewis & Lewis, our solicitors, we hereby undertake to indemnify you for any damage or costs which you may incur from any action on the part of the Medical Battery Company or the Zander Institute"

[Reading the letter.]

Then there is a letter of the 23rd, undoubtedly from Simpkin, Marshall & Co., addressed to Alabaster, Gatehouse & Co.:

"Gentlemen, we have not yet received the letter of indemnity which you were to send us."

That implies that there must have been some communication passed before:

"Please give same to bearer now in order that the sale of the ELECTRICAL REVIEW may not be interfered with."

The WITNESS: I cannot explain that.

The LORD CHIEF JUSTICE: You cannot doubt the *bona fides* of this. There is some little trouble about the dates. It may have been written and not sent, or it may have been sent to one house and not reached the other, but it is plain there had been communications, and in consequence of them this indemnity was given. That is quite plain.

Mr. EDWARD WILLIAM ALLEN, sworn, examined by Mr. BANKES:

I think you carry on business at Ave Maria Lane as a newsagent?—I do.

Did you receive a copy of the lithographed circular?—I did.

Had you up to that time been in the habit of selling the ELECTRICAL REVIEW?—Yes.

In consequence of the receipt of the circular, what did you do?—I immediately sent one of my assistants up to Messrs. Alabaster to show them the letter, and to ask them what they intended doing in the matter.

What occurred then?—They sent me a letter of indemnity almost a fac-simile of what I have heard read.

Then you continued the sale?—Yes.

Sir EDWARD CLARKE: I have no question.

Miss CATHERINE DAVIS, sworn, examined by Mr. BANKES:

Is your business at 1, Imperial Arcade, Ludgate Hill?—Yes.

Do you carry on the business of a newsagent there?—Yes.

Did you receive the circular from Mr. Fleet?—Yes.

Up to that time had you been in the habit of selling the ELECTRICAL REVIEW?—Yes.

What did you do upon receipt of the circular?—I sent it to Mr. Alabaster.

What occurred then?—I saw Mr. Alabaster in the evening of the same day.

Did he give you a letter of indemnity?—No, he told me that I was to have no fear of selling the paper.

Upon that did you go on selling it?—Yes, I did.

Did you stop selling it at all, or was it the same day that he saw you?—It was the same day.

Cross-examined by Sir EDWARD CLARKE: It sold as well afterwards as it did before, did it?—Yes, better.

Mr. GEORGE VICKERS, sworn, examined by Mr. BANKES.

Do you carry on business at 1, Angel Court, Strand?—Yes.

You are a newsagent?—I am.

Have you been in the habit of selling the ELECTRICAL REVIEW?—Yes.

And did you receive this circular by post?—I did.

Upon receipt of the circular what did you do?—I wrote to the proprietors of the ELECTRICAL REVIEW, and sent them a copy of the letter.

The LORD CHIEF JUSTICE: Of the letter you received?—Yes, my Lord.

Mr. BANKES: What did you get in answer?—I got an indemnity indemnifying me against all proceedings.

Sir EDWARD CLARKE: Have you got it?—Yes [producing same].

Mr. BANKES: Upon that did you continue to supply the paper?—I did.

Do you know what day you received the circular?—No, I wrote to the plaintiffs the same day as I received it.

The same day as you received the circular?—Certainly.

Did you get the indemnity back by return?—Yes, I cannot say positively by return, but within a very short time.

Cross-examined by Sir EDWARD CLARKE: I see this is dated the 17th September. I am not sure from looking at that whether they are lithographed or not. It appears to have been a circular sent out by them on the 17th September.

The LORD CHIEF JUSTICE: Yes; they are exactly the same.

Sir EDWARD CLARKE: Then you went on selling?—Certainly.

Did you sell better afterwards than before?—I could not say one way or the other—about the same I should imagine.

The LORD CHIEF JUSTICE: The only difference is that the one to Messrs. Simpkin & Co., is addressed to them, and this commences merely "Dear Sir," but all the rest of it seem to be exactly the same line for line.

Mr. BANKES: They are not lithographed, my Lord, I think.

The LORD CHIEF JUSTICE: It is not all lithographed. Messrs. Simpkin's letter is addressed at the head of the letter, and this gentleman's is addressed at the end of the letter.

Mr. BANKES: As soon as ever we found out what was going on we took advice, and got an indemnity out as soon as we could.

The LORD CHIEF JUSTICE: You may take it they are substantially the same.

Mr. BANKES: I have a number of other witnesses, but I think I have given sufficient evidence of that class.

The LORD CHIEF JUSTICE: I think I may ask you to do this, Sir Edward. I do not ask you to make any admission, but I think you might say that you will not comment on no more being called.

Sir EDWARD CLARKE: I thought I had been able to reduce this to a question of money damage, which is obviously the simple question. This is an action for an injunction, and there is money damage mentioned in it. Of course, I do not make any admission.

The LORD CHIEF JUSTICE: No, I do not ask you to make admissions, but you may as between us say that in your speech you will not comment on no more having been called.

Sir EDWARD CLARKE: No; but I shall say that those who have been called do not come to much.

The LORD CHIEF JUSTICE: Yes, of course, those are at your disposal.

Sir EDWARD CLARKE: If your Lordship pleases.

The LORD CHIEF JUSTICE: I thought that might be arranged.

Mr. BANKES: I will now call evidence on another part of the case.

Mr. FRANCIS REEVES, sworn, examined by Mr. BANKES:

Do you carry on business at Mansion House Buildings, Queen Victoria Street, as an electrician?—Yes.

Do you know Mr. C. B. Harness, the managing director of this Medical Battery Company?—Yes, I know Mr. Harness by meeting him in the train simply.

You have met him in the train?—That is all.

Did he speak to you with reference to this circular which had been sent out?—Yes.

Did he say anything with regard to the numbers he had sent out?—500.

Do you ever see the ELECTRICAL REVIEW?—Yes, regularly every week.

Do you from your own reading of it know that articles have appeared from time to time, commenting on these belts of Mr. Harness?—I do.

Has that extended for some considerable time back?—Yes, for a long time back.

Has Mr. Harness ever spoken to you about the proprietors of the ELECTRICAL REVIEW?—Yes.

When first did he mention the subject—I mean about?—A very long time ago, when the articles first began to appear.

What did he say?—Naturally, he was very angry and threatened all sorts of penalties and punishments, and said he would probably end by driving them into the workhouse.

Has he mentioned that or talked in that way on more than one occasion?—Yes, on several occasions.

Did he mention the names of the proprietors?—Yes.

Who were they?—Particularly Mr. Gatehouse.

Did he mention any other?—And Mr. Alabaster.

Cross-examined by Sir EDWARD CLARKE: You said that Mr. Harness was naturally very angry?—Naturally, he would be.

At the sort of article that had been written about him?—At anyone writing an article attacking the mode in which he got his living.

These articles had attacked him somewhat bitterly, had not they?—Yes; you have heard some of them read.

I am just trying to go back to your conversation with Mr. Harness. At the time you had this conversation that you have told us of with Mr. Harness, were you travelling in the train with him?—Yes.

You used to travel up and down to town?—Yes; we lived at the same place.

So that you would have the pleasure of seeing him just after he had read the last new article?—Yes.

And he naturally was very angry?—Yes.

And in the confidence of private friendship he expressed that to you?—I am not a friend of Mr. Harness', I am only an acquaintance—a railway acquaintance.

Then in the confidence of a railway acquaintance he expressed his feelings to you?—Yes.

Did you yourself read the ELECTRICAL REVIEW from time to time?—Yes.

The ELECTRICAL REVIEW made the Harness subject rather a leading subject?—No, it was a sort of bye subject.

It came down upon it a good many times?—Quite so.

And when this circular that is in question here was issued the ELECTRICAL REVIEW reprinted it, did not they?—It did, and published its guarantee to the publishers or the sellers at the same time.

Then within a day or two after this circular was issued the circular itself was published in the ELECTRICAL REVIEW, and also the guarantee which the ELECTRICAL REVIEW people gave to the sellers?—Yes; I think that was so.

And between them they have managed to send up the circulation of the ELECTRICAL REVIEW?—I know nothing about that.

Re-examined by Mr. BANKES: You have been asked whether this was told you in confidence. Was it told you in the railway carriage?—Yes, in the railway carriage or walking along the road.

Sir EDWARD CLARKE: I do not think the locality makes any difference.

The WITNESS: I should like to say I am here under a subpœna. I have not come voluntarily.

Sir EDWARD CLARKE: I am not making any complaint.

Mr. D. JEFFERY called.

Sir EDWARD CLARKE: My learned friend has told me what this witness's evidence refers to. This is a witness upon a different class of matter and I will take your Lordship's ruling at once with regard to the extent to which my friends are entitled, upon this action, to go into the class of evidence which has been indicated by my friend Mr. Finlay. I understand that in my absence my friend Mr. Germaine did interpose, and your Lordship thought that it would be better to deal with it later on.

The LORD CHIEF JUSTICE: I said I would not stop it because I could not tell. It must depend on circumstances.

Sir EDWARD CLARKE: Your Lordship pleases. Now I want to call your Lordship's attention to the pleadings in this action, and I submit to your Lordship that the class of evidence which it is now proposed to give, to which my friend Mr. Finlay has referred, is not admissible upon the issues which are here upon the record. My Lord, this is an action for libel founded upon a circular by which the solicitor, acting on behalf of the defendants, warns persons engaged in selling periodicals against selling a paper which he says has contained malicious libels upon his principals; and the notice is given in reference to a case, which your lordship will remember, of Emmens v. Pottle, where an action was brought against a newsagent in the City of London for selling a paper which contained, or was alleged to contain, a libel. It is reported in Law Reports 16, Queen's Bench Division, p. 354. It was an action against Messrs. Pottle, the well-known newspaper agents at the Royal Exchange, claiming damages for libel, an article having appeared in a newspaper known as *Money*, which was stated to have been sold by the servants of the defendants; and at the trial of that action it was held by Mr. Justice Wills that the defendants were entitled to judgment upon this finding of the jury:

"That the defendants did not nor did either of them know that the newspapers at the time they sold them, contained libels on the plaintiff; that it was not by negligence on the defendant's part that they did not know there was any libel in the newspapers, and that the defendants did not know that the newspaper was of such a character that it was likely to contain libellous matter, nor ought they to have known so."

The learned judge entered judgment for the defendants, and the Court of Appeal, upon argument, upheld that judgment for the defendants upon the ground that they had not received any notice, nor had reasonable ground for suspecting that the paper that they were selling would contain a libel. Well, my Lord, in that state of the law, it would not be possible for persons, with regard, to whom articles were published of a libellous character in a newspaper, to recover damages from the newsagents who might be circulating the libel, unless they had given them some intimation of the danger they were in, in publishing a paper containing the libel; and in order to give them that notice this circular is issued by the solicitor of the defendants. And, my Lord, it is issued by the solicitor to the defendants at a time when the defendants are instituting an action against the proprietors of the newspaper for the libels which they allege to be contained in those newspapers. In these circumstances the action is brought against the defendants for libel in that circular; and your Lordship will observe the pleading. It sets out the circular, and puts this innuendo:

"Meaning thereby that the plaintiffs availed themselves of their said newspaper to maliciously attack the defendant company, and made a practice of intentionally publishing therein libels on the said company."

Then—

"Alternately the plaintiffs say that the sale of their said newspaper was chiefly carried on through news and advertising agents, as the defend nts well knew, and the defendants contriving and intending to injure the plaintiffs in their business falsely, maliciously, and without lawful cause procured and caused the writing and publishing to the said agents of the plaintiffs, and of and concerning their said newspaper, and the bills and placards thereof the words set out in the preceding paragraph, meaning thereby that their said newpaper was one in which the publication of malicious libels was maliciously practised, and that it was a newspaper of a scurrilous character, and the selling and publication thereof, and of the said bills and placards was attended with considerable risk of civil or criminal proceedings."

and then it alleges that

"By reason of the aforesaid libels a number of the said agents have refused to continue the sale and distribution of the said newspaper, and the sale thereof has largely diminished, and the plaintiffs have suffered considerable damage, and their credit and reputation have been injured."

Now, my Lord, the only defence that is put upon the record is the defence that this was a privileged communication, or

"a communication made to certain newspaper vendors, to give them the notice necessary in law to make a newspaper vendor liable for the dissemination of libels, and that the defendants then intended to bring an action at law in respect of the publications therein referred to, and to vindicate their legal rights in respect thereof both as against the plaintiffs, and as against all newspaper vendors who after such notice should further sell such publications, and that the defendants have in fact issued a writ against the plaintiffs to enforce such rights as aforesaid, which writ was served upon the plaintiffs, prior to the delivery by the plaintiffs of their statement of claim, and the defendants say that they claiming such right, and intending to enforce the same, and in fact enforcing the same against the plaintiffs were entitled to write, and were bound in law to write, such letter in order to substantiate such rights as against the said newspaper vendors."

Well, my Lord, upon that defence issue is joined simply. There is no further reply; and the only question, as I submit, is whether this was published upon a privileged occasion; whether the defendants were not privileged in sending out to the newsagents this warning of the course which they were going to take. Now, my Lord, this matter has been substantially discussed in the case of Wren *v.* Weild, which is reported in the Law Reports 4th Queen's Bench. That was a case in which the plaintiffs brought an action alleging in the declaration that the defendant

"falsely and maliciously wrote to and told persons who had bought certain machines of the plaintiffs, that the machines were infringements of the defendant's patents, and that the defendant claimed royalties for the use of the machines, and that if they used the machines without paying royalties, he should take legal proceedings. The defendant pleaded not guilty. The plaintiffs at the trial offered to prove various specifications and machines existing before the date of the defendant's patent to show that the defendant's specifications claimed matters that were not new, and also that the defendant had used them. The judge ruled that as the defendant's patent was still subsisting, and not set aside on *scire facias*, or otherwise, the evidence was immaterial, and directed a nonsuit."

Then the holding is this:—

"The ruling of the judge was right; that where a person claims a right in himself which he intends to enforce against a purchaser,"

that is our case as between ourselves and the newspaper—

"He is entitled, and, in common fairness, bound, to give the intended purchaser warning of his intention; and that no action lies for giving such preliminary warning, unless it can be shown either that the threat was made *mala fide*, only with the intent to injure the vendor, and without any purpose to follow it up by an action against the purchaser, or that the circumstances were such as to make the bringing an action altogether wrongful."

Well, my Lord, if he intended to bring an action against the plaintiff in this action of libel it would be an *a fortiori* case, I think. If the Defendants here intended to bring their action against Alabaster and Company, who are the owners of the ELECTRICAL REVIEW, in respect of the libels contained in that paper, then they were not only entitled, but in common fairness, bound to give notice to other persons who might be selling this libel, in respect of which they were going to bring an action, of the danger which they ran.

The LORD CHIEF JUSTICE: I do not see that. If they are going to bring an action against A., I do not see that it is their duty to give notice to B.

Sir EDWARD CLARKE: Because their action might be against B. as well.

The LORD CHIEF JUSTICE: It might, but if they only aver that they are going to bring an action against A., I do not see the necessity of telling B., C., D., and all the letters of the alphabet, that they are going to bring an action.

Sir EDWARD CLARKE: Unless they do they could not avail themselves of any process—

The LORD CHIEF JUSTICE: Yes; A. is the writer of the libel.

Sir EDWARD CLARKE: But B., C., and D. are the persons who would be selling the libel.

The LORD CHIEF JUSTICE: You do not say in your pleadings that you are going to bring an action against them, but that you are going to bring an action against the writer, or supposed writer.

Sir EDWARD CLARKE: It is to avoid bringing the actions against them.

The LORD CHIEF JUSTICE: However, what seems to me to be more important is, that you describe these articles as malicious libels; by which description you impute to the writer of these articles that they were written not in the interests of science or of truth, but in their own interests, to crush a rival or another person. At all events, that would be not an impossible interpretation, and an interpretation which I cannot withhold from the jury.

Sir EDWARD CLARKE: Of course, it has been held that a libel imports malice. It does not, I submit, alter the matter that that word "malicious" was put in. It does not displace the privilege which attaches to the defence; and the only question here is privilege, because there is no justification on the record with regard to this matter, and the point which I wish to press upon your Lordship is this, that—

The LORD CHIEF JUSTICE: First of all, as far as I can judge, I do not think there is privilege; but at all events, if there is privilege, I shall put to the jury whether the privilege was exceeded. Therefore, whether I am right in thinking that the doctrine of privilege does or does not apply is immaterial, because if it does not, then *cadit questio*. If it does, then still I must ask the jury whether they, from the terms of the letter itself, do not infer malice.

Sir EDWARD CLARKE: Then I submit to your Lordship that on these pleadings there is no issue raised upon which it would be relevant to prove; on the one side or the other, the character of the appliances or the results which have followed.

The LORD CHIEF JUSTICE: Yes, I think so. Of course I have not heard a word of your case, and you will understand, therefore, I am giving my opinion from what I have heard from Mr. Finlay, and nothing else. I do not affect to prejudge it, and I do not wish to do so in the smallest degree. It may be the most valuable thing in the world, but the plaintiff has a right to say, "I, in the exercise of my duty or privilege, or, at all events, as a scientific man, have a right to denounce what I think a gross imposture, and I have done so." You say, "yes, you have done so, and you have done so in the course of malicious libels"—I will drop the word "malicious" if that is the least trouble to you. The plaintiff says, "You impute to me that I wrote the articles, not as a man of science but as a man with a bad object, and to crush you," and that would not be true if the things in respect of which he wrote the article are worthless. That is how it strikes me.

Sir EDWARD CLARKE: Then, I submit, the only evidence on that would be the evidence of the writer of the articles, on the one hand, with regard to what was in his mind at the time he wrote these articles, and that the question of the truth of the statements contained in these articles cannot be an issue triable in this case.

The LORD CHIEF JUSTICE: Yes, I think so, because if it should be made out to the satisfaction of the jury that this is all rubbish, then it is not a libel to say so.

Sir EDWARD CLARKE: Well, in one sense it is a libel, if it is justified by its truth.

The LORD CHIEF JUSTICE: Well, every defamatory statement is a libel, but it is not a libel for which an action would lie.

Sir EDWARD CLARKE: No, but I submit a justification ought to have appeared on the record, and been there raised as an issue. Let me point out the difficulties which arise in this case. We have brought our action against the plaintiffs in this action, in which we were proposing, or the Medical Battery Company were proposing, to try the value of all these appliances. That action stands for trial at a very early date. It is down in the list.

Mr. FINLAY: It was not begun until after we had brought our action.

Sir EDWARD CLARKE: It was begun immediately afterwards. It was begun the next day.

The LORD CHIEF JUSTICE: I should not let that affect my judgment in the slightest degree, because I must look at this set of papers by themselves.

Sir EDWARD CLARKE: What I was going to say was this: that that action having been brought, in that action we proposed to try the question of the value of these appliances and the whole of these matters.

The LORD CHIEF JUSTICE: But I have not seen those papers. I know nothing about that; of course, I know you would not tell me anything you were not instructed to tell me.

Sir EDWARD CLARKE: I will tell your Lordship that the actions are for libels in respect to these very articles.

The LORD CHIEF JUSTICE: I cannot allow that to influence me in the slightest degree, because you are not bound to go on.

Sir EDWARD CLARKE: No, but if this issue is to be tried at all between us, I should say it should be tried in an action where the issue is distinctly raised, and where the jury can be asked a question, the answer to which would say distinctly, one way or the other, whether the plaintiff or defendant was right in the controversy about these appliances. Now, the verdict of this case would not be upon that issue. It would not be upon that issue, in the sense of making the finding of the jury a binding decision, as between the parties. Now, my Lord, we have not come here prepared for trial with regard to all these matters which have been opened by my learned friend. We certainly were under the impression that all these matters would be tried in the action in which the issue was legitimately and fully raised, and I should make this application to your Lordship, that this case might stand over, or be consolidated with the other action, in order that the whole issue may be raised as between these parties, upon an issue which would make a final and effective determination of the matters in question. Of course, if there are any terms with regard to costs, that your Lordship thinks fit to impose, we must submit to those, and ask your Lordship to deal with the matter, possibly, at a later time; but at present my clients certainly are not in a position to deal with this issue; all the witnesses are not available to deal with all the issues which have been raised by my learned friend to-day. Therefore, I should submit that those issues are not triable upon the case which is now before your lordship.

The LORD CHIEF JUSTICE: Do you want to add anything more, Mr. Germaine?

Mr. GERMAINE: No, my Lord.

Mr. FINLAY: I submit that the case of Wren v Wield, which my friend relied upon, really has no application at all. To begin with, that was a case of what is called slander of title—a statement with regard to the merits of a patent, or of goods. It has no application, whatever, to such a case as the present, where a personal charge of a serious nature is made against the managers of the ELECTRICAL REVIEW. In the second place, it appears from the very terms of the judgment, in Wren *v.* Wield, that the doctrine of that case will have no application, if there was *mala fide* in the making of the attack.

The LORD CHIEF JUSTICE: Certainly.

Mr. FINLAY: Now, here, my Lord, we say that this circular was not sent *bona fide* for the protection of the defendants' interests. My friend makes a suggestion which I can hardly suppose is serious,

that it was to found possible actions against all these newsvendors—500 actions against newsvendors.

Sir EDWARD CLARKE: No. I said it was the necessary condition before we could make any claim against them.

The LORD CHIEF JUSTICE: I have decided in my own mind against that part of the case.

Mr. FINLAY: Then with regard to the proposal that this case should stand over, I really must object to that for this reason—that the Medical Battery Company did not bring their action against us until after our action against them had been commenced; and that their action is not even set down for trial. It is quite impossible to suppose that the defendants did not appreciate that the question of their *bona fides* in sending out this circular would be at issue, and I very respectfully submit that we ought not to have our case postponed until another action, which the present defendants have not really pushed on as they might have done, should be reached. I should remind your Lordship of this, that there was a preliminary action brought, the costs being provided for, as it appears, by Mr. Harness, in the name of Dr. Tibbits. It was proved at the trial, and there is no harm in my mentioning it, that Dr. Tibbits was an undischarged bankrupt. The costs of bringing that action for reflections on Dr. Tibbits's commendation of this process were provided by Mr. Harness. That case was tried some time ago, and I submit that it really would be unheard of that when the plaintiffs have brought this action to vindicate themselves from so serious an aspersion, the vindication of their character should stand over till the present defendants thought fit to bring their action on for trial.

Sir EDWARD CLARKE: I should like to say, in regard to any question of our thinking fit to bring the action on for trial, that our action against the plaintiffs here was begun the next day, I believe, after the writ in this action was issued; that what has happened there is that the plaintiffs in this action have pleaded in a way which the Divisional Court the other day did not think was satisfactory, and I think my learned friend Mr. Bankes, who was put under terms to amend his statement of defence in that action, has not yet amended. I think that is so. So that it is not our fault, at all events. We should have been happy to assist.

Mr. BANKES: I had liberty to amend, but I did not amend.

The LORD CHIEF JUSTICE: Is that some performance of mine, Mr. Bankes?

Mr. BANKES: No, my Lord, it was mine.

The LORD CHIEF JUSTICE: Was the judgment one to which I was a party?

Mr. BANKES: No, my Lord, Mr. Justice Day and Mr. Justice Collins.

Mr. FINLAY: We were satisfied with the defence as it stood.

Sir EDWARD CLARKE: Mr. Justice Day and Mr. Justice Collins struck out some of their statement of defence giving them leave to amend, and we have not yet had notice whether they are going to amend, or going to rest upon their defence as it stands.

The LORD CHIEF JUSTICE: You know now that they are not.

Mr. FINLAY: That is weeks ago.

Sir EDWARD CLARKE: Certainly; that is the reason why we ought to have had notice, so that we could have gone on.

Mr. BANKES: You could have set it down for trial.

Sir EDWARD CLARKE: I was not in that case.

The LORD CHIEF JUSTICE: I must decide this upon the very narrow ground and upon considerations which apply only to this state of pleadings. In my judgment the evidence that is proposed to be given is distinctly relative to an issue that is distinctly raised; that is, the *bona fides* of the plaintiffs in writing the articles or in publishing and being responsible for the articles in the ELECTRICAL REVIEW. They say in effect that they have done that as I said just now, as men of science to expose a scientific humbug. Well, on the other hand, it is said "you did not do that; you did it simply to injure this Company and to injure us." Well, that is a matter that the real merit of the subject of those articles is most material to, and I cannot myself see that I can help receiving the evidence. I do not say I wish to help receiving it, but I do not see how I can. Upon common principles it seems to me to be fairly raised, and therefore, I must fairly hear it. That you may answer it is another matter. I give you no opinion whatever upon that. I know very well what an impression a clever man may make in the opening, and I keep my mind open. I cannot say it is outside in my judgment. If I am wrong, I can be corrected.

Sir EDWARD CLARKE: Your Lordship does not think right to adjourn the hearing on any terms?

The LORD CHIEF JUSTICE: No, I do not think I have any right to do that. There is no ground for it. It appears to me properly to arise, and, therefore, as it properly arises, you ought to be prepared to meet it. I cannot, because you have another action pending which you may or may not prosecute, adjourn this.

Sir EDWARD CLARKE: Well, my Lord, then I am instructed by my clients to say, upon your Lordship so deciding, that they are not prepared to deal in this case with the issues which have been indicated in the opening of my learned friend, Mr. Finlay, and which they certainly were under the impression were not raised upon the pleadings in this case. Therefore, I shall take no part in the controversy if these witnesses are called, but am prepared at this moment to admit that it is a libel, in respect of which damages must be paid, and to leave the jury to assess the damages upon the evidence which is relevant to that issue. [Laughter.]

Mr. FINLAY: Gentlemen, the course that has been taken by my learned friend, Sir Edward Clarke, brings this case to a very early termination. It is a termination which I should think very few that were not very much behind the scenes indeed would have expected; because up till the present moment the defendants had shown a bold front. We come into Court; we tell them, what they must have known now for a long time, that our case is, that this very serious attack upon the personal character and professional honour of the plaintiffs was not made *bona fide*. The suggestion is put forward that the circular was sent out to 500 newsvendors by way of fulfilling a condition precedent to possible actions against those newsvendors. Gentlemen, it is a suggestion which we have heard gravely put forward, but about which I shall say nothing. The defendants must have known—I am entitled to say so much as that—that our case was that the articles were not written with any object of the kind; that when the defendant wrote to the plaintiffs that they were guilty of publishing malicious libels about him and sent round that circular to every newsvendor in the country he could think of, our case is that he was making an attack which he knew to be unfounded; that he resented the criticism which appeared of his institute—an institute carrying on a business which, however fruitful in suffering to his fellow creatures, put vast amounts of money into the defendant's pocket. Our case was that the defendant, resenting the exposure of the system which was being carried on at his institute, though fit to characterise these articles in the ELECTRICAL REVIEW as malicious libels. Now, gentlemen, what is the conduct of the defendant? He perfectly well knew what he had to meet. He cannot fail to have known it. We come into Court. We offer to call witnesses to substantiate the facts which not very long ago I opened to you; and the course which he takes now is to say that he is not prepared to meet that evidence; that he admits that it is a libel, and that it is a mere question of damages. Now, gentlemen, I call your attention to this: not prepared to meet this evidence! Gentlemen, why is he not prepared? It was not time that was wanting. It was not knowledge that it would be material. The defendant has had the advantage of the able assistance of my friends who are engaged in the case. He has had the assistance of his solicitor. You are asked to suppose that it never occurred either to the defendant or to any of those able gentlemen by whom he was advised, that the question of his honesty and good faith in making these attacks upon the plaintiff's conduct would come into issue. Of course he knew it. Why is he not prepared? It is not a question of time. He is not prepared, because he never would be prepared to face such an issue as that. [Applause.]

The LORD CHIEF JUSTICE: Stop, stop, if that is repeated the Court will instantly be cleared. I have heard it said that is sometimes an unreal observation. In my mouth it is very real. I exceedingly dislike a Court being turned into a place where counsel are to be cheered and counter-cheered, and I will not have it done in a Court where I sit. If that is repeated, the Court will be cleared, except of the parties who are actually interested in the case.

Mr. FINLAY: Gentlemen, was such a thing ever heard of before—a charge of so serious a nature; a charge relating to that pamphlet, to the nature of which I called your attention in outline, whole portions of which I abstained from reading. When the defendant came into Court, knowing that he had to deal with the question of his *bona fides* in making such a serious attack on the plaintiff, was it ever heard of before, that any defendant should shrink from such an issue after having persevered so long? The question for you, gentlemen, is one of damages. I ask you, gentlemen, in dealing with that question, to take into account two things In the first place, I ask you to take into account the nature of the attack made on the plaintiffs by the defendant. I ask you, could there well be a more serious attack than to impute to professional men, conducting a scientific journal, that they were prostituting that journal for the purposes of personal and malicious attack upon a man whose business they desired to injure? The plaintiff's case is—and I have to treat that case now as established—that they inserted these criticisms for the purpose of calling the attention of the public to an extensive system of imposture which was going on, for the purpose of calling the attention of the public to the way in which its weaker members were being fleeced; for the purpose of opening the eyes of those who are open to information upon scientific subjects, to the way in which people, suffering especially from disorders of the nervous system are preyed upon by people like the defendant, whom I shall not characterise by that simple and expressive epithet which would perhaps be most appropriate. Gentlemen, I ask you to bear in mind that the defendant has thought fit to charge the plaintiffs with prostituting their journal for the purpose of making personal attacks, when in fact they were opening the eyes of the public to the way in which the public was being gulled. I ask you, gentlemen, to bear in mind another thing, and that is the conduct of the defendant. Here you have a man carrying on a business, enormously advertised, to which that book, to which I have called your attention, relates, and which is carried on at the institute about which you have heard something from me, and of which, if the defendant had dared to face the inquiry, you would have heard a good deal more from the witnesses. Here you have got the defendant in control of an institution of this kind fighting the case until we come to the point, and then, when he finds that he has to face an inquiry into the question whether this is a real institute at all—whether these electropathic belts do any good to any human being; whether he was acting *bonâ fide* in what he wrote with regard to the plaintiffs, he shrinks from the inquiry; withdraws from the field, and says the whole matter is a question of damages. Under these circumstances, I ask you to award very exemplary damages indeed, and to mark your sense of conduct most unworthy of any man who ventures to describe himself as in any way belonging to the honourable profession of medicine. Medical electrician, forsooth! Gentlemen, a man who, in an inquiry of this kind, can shrink from insisting on having it probed, and thoroughly probed, and vindicating his honesty if he can—a man of that sort ought for ever afterwards to blush at in any way endeavouring to associate himself with so honourable and so distinguished a profession as that of the healing art.

Sir EDWARD CLARKE: May it please your Lordship, gentlemen

of the jury, my learned friend having it all his own way, has been very violent in the address which he has addressed to you. He appears to have addressed you as if all the matters which he stated in his opening in this case were to be assumed by you to have been established in evidence. That is not the condition of things at all. Gentlemen, there is, as you have already heard, a case pending, in which the defendants in this action, the Medical Battery Company, are the plaintiffs, and in which the owners of the ELECTRICAL REVIEW are the defendants, and in that case would be the proper time, as was thought by those who were associated with the defendants in this matter, at which this issue should be tried as to whether the articles in the plaintiffs' review were fair or not or to whether they really were malicious libels. Upon the issue in the pleadings in this case the statement of the plaintiffs was this, that by reason of this circular being sent out by the solicitor to the Medical Battery Company, a number of agents had refused to continue the sale and distribution of their newspaper, and the sale therefore has largely diminished, and the plaintiffs have suffered considerable damage and their credit and reputation have been injured Now, as a matter of fact, upon the evidence that has been given upon that, a legitimate subject of inquiry in this action, it appears that the plaintiffs have not suffered at all. So far from the circulation of their ELECTRICAL REVIEW having been interfered with and diminished, they do not venture to call into the witness box the owner of the ELECTRICAL REVIEW or the publisher of the ELECTRICAL REVIEW; and why? because he would be able to tell you how much, on the whole that had happened, which one of those witnesses stated in the box, had happened with her; that after this circular had been issued, the circulation of the ELECTRICAL REVIEW went up. In this case, my learned friend, with magnificent energy and indignation, is endeavouring to ask you to give damages to the proprietors of the ELECTRICAL REVIEW because someone published a letter by which they have substantially profited. They are better off from this letter having been published, in the respect that the circulation of their paper has increased since the time of this publication. But now my friend says that they are entitled to damages, apparently, on other grounds. He throws over the question of their losing in the circulation of the ELECTRICAL REVIEW; admits that he cannot prove any diminution; that rather it has increased since then; but then he says, "I am entitled to damages on the grounnd that you have sent out a circular in which you complain that malicious libels have been published in the ELECTRICAL REVIEW." Now, gentlemen, those libels in the ELECTRICAL REVIEW, the truth of which would have to be tried by a vast amount of scientific evidence, and the evidence of patients on both sides—those articles, whatever they were, however they might be believed to be justified by the persons who wrote them, were, undoubtedly, violent attacks upon the Medical Battery Company, and upon all connected with that company—attacks in which the writer did not content himself with saying that the appliances were not of real use, and did not content himself with saying that there was exaggeration in the representations that were made, but went on to say that there was actual fraud and deceit in the conduct of the business of the Medical Battery Company. Well, from the point of view of the manager and the persons associated with the Medical Battery Company, was it a strange thing that these articles should be called malicious libels? It was quite clear that the two parties were coming to issue over this matter, and it was quite clear, I think you would gather from those papers that are before my Lord—that is that circular sent out on the 17th September (the very day after the defendent's circular was printed), in which the plaintiffs here offer an indemnity to persons who will sell the ELECTRICAL REVIEW—it was quite clear that the area of controversy was being removed from the newspaper office, and must find its ultimate determination in a court of law. In this case the two parties both take their respective steps. On the one hand, Mr. Fleet, the solicitor to the defendants in this case, drew up and sent out the circular in which the words "malicious libel" appear. Undoubtedly his clients instructed him to protest against the attacks that had been made against them as malicious libels. On the other hand, the ELECTRICAL REVIEW sent out a circular to people, in which they said, "We are prepared to indemnify you against any costs you may be put to, or any steps which may be taken against you through your selling the ELECTRICAL REVIEW." Those two steps were taken, and, I venture to suggest to you, taken in good faith. The parties had to meet each other legally, one way or the other, and to decide their issues in a court of law; and so each side took the step which was proper and appropriate for him to take in the circumstances, was it not right of the solicitor to the Medical Battery Company in these circumstances to send out a circular to newsagents. Well, what was the position of things? In this paper, week after week, articles were appearing attacking his clients, and attacking them in a way which would not only add to the injury of which they were about to complain in a court of law, but would, to a certain extent, affect the minds of those who might come across them and read them, and who might by and by have to determine their relations with each other in a court of law. Now, of course, when a libel appears in a periodical, that periodical goes all over the town, or the country, or it may be, goes all over the world; and if there has been no reason on the part of a newsvendor to believe that it would contain libels, there can be no complaint or remedy against him whatever damage the libels might do. It is quite conceivable to any one of you that a libel upon an individual published in a weekly number of a certain periodical, and sold, say, at the back of the Royal Exchange, might go all over the city and ruin that man in the course of twenty-four hours. If there is a probability of things being published in a paper which are injurious to the reputation either of an individual or a company carrying on business, is it not only legitimate, not only the right, but the duty of the man complaining of these libels to send to the newspaper agents and to say "We warn you against circulating the paper containing those libels. Of course, the proper course was taken directly by the principal newsvendors. It is perfectly clear that W. H. Smith & Sons, Vickers & Sons, Simpkin, Marshall & Co., communicated directly with the proprietors of the ELECTRICAL REVIEW, and they got an indemnity, and when they have got an indemnity then the thing has been put in such a position that if anybody is to suffer in a court of law, it will not be the newsvendor, but the proprietors of the paper who have sent out the libels and sent them to him. So that the only effect of issuing this circular was that it transferred any possible liability from the newsvendor on to the shoulders of the right persons—the proprietors and the writers of the ELECTRICAL REVIEW. There is the legitimate object of such a circular. Here is the circular which was written, and when you listen to the terms of it I shall ask you (it is for your judgment) whether it is not a reasonable and proper circular to be written by a solicitor on behalf of an individual or a firm or a company which is being attacked so violently as this from day to day:

"Sir,—Having been consulted by my clients, the Medical Battery Company, Limited, the proprietors of Harness's Electropathic Belts, and also the Electropathic and Zander Institute of 52, Oxford Street, W., with reference to some malicious libels published in the ELECTRICAL REVIEW and a paper called *Science Siftings*, I beg to give you notice that if these or any future publications containing defamatory articles or paragraphs are sold or circulated by your firm, my clients will hold you responsible. In the same way you will be held responsible for the exhibition of any libellous bills or placards."

Of course, in front of any newsvendor's shop there might be put a bill or placard containing a gross libel upon any person or any firm or any company, and the only fair way of stopping that is to call the attention of the newsvendor to the character of the periodical which he is circulating. A newsvendor gets 50, 60, or 100 periodicals sent to him every week. From the publishing office of each of those periodicals comes a man with his quire of copies and he leaves them, as we hear, on the chance that somebody may come in and buy a copy, and he calls at the end of the week and takes away those that have not been sold. Some notice of that kind must be given to the newsvendor. It is absolutely impossible that he should read through the periodicals which are in that way left for him to sell, and the newsvendor without any fault on his part, but quite innocently, would become liable to an action for extending the circulation of a libel which at that very time it is proposed should be brought for discussion and decision before a court of law. My friend has said that he does not understand how it is that in this case the defendants should shrink from dealing with the issues that are raised on this matter. Now you heard the contention which I submitted to my Lord. Of course, my Lord's judgment is conclusive with regard to that matter. I do not say a syllable more about it, and it is conclusively laid down now that upon these pleadings the plaintiffs would be entitled to go, at any length that suited them, into the history of the defendant's establishment, and into all these scientific questions which were rather hinted at than discussed in my learned friend's opening; and we might have discussed before you, for the space of a week, the questions with regard to discs, and insulation, and points, and webbings, and all the rest of it; the materials of which these belts are formed, and the results which undoubtedly, in many cases, might be shown to have been obtained from the use of them—results which might or might not be traceable by electricians and scientists to some particular forms of electrical action. Very well, that was the sort of issue to which we were invited, and invited to it upon a case where, although undoubtedly after the decision that has been given, it was admissible in evidence, the verdict that you would have had to give would have been simply the question whether there was malice in the circular which has been put before you, which I read, and your decision upon that might have been governed, and might perfectly well have been given upon the evidence of that Mr. Reeves; for that was in itself perfectly good evidence, as far as it went, of malice against the defendant; and although my clients might have, in your judgment, succeeded, at the end of a week, in establishing that their remedies were contrived in good faith and administered in good faith, and had, in fact, produced satisfactory results, yet, if you believed the evidence of Mr. Reeves, that Mr. Harness had told him that he would bring the plaintiffs in this action to the workhouse, and you thought that there was that intention in his mind, although you had been in my favour upon every other issue in the case, you would have been entitled, nay, perhaps you might have been bound, to find a verdict for something against me on the question of the libel. Gentlemen, in these circumstances we did not accept the task of going through the whole investigation of this case, but preferred that it should end now with an admission on the part of my clients that this was a libel, in respect of which some damage must be given. What damage is to be given? I ask you to say that, upon the evidence that has been given, no damage whatever has been proved. They have picked out from the 500 persons—for that now has been given in evidence, that 500 circulars were sent out—they have picked out of the 500 persons, those whose evidence could best help them, or best be suggested to show that they had suffered damage in connection with this circular, and as each one came into the box it practically appeared that no damage had been sustained at all. All the persons who sold considerable numbers went on selling after that circular, and sold at least as many as they had before the circular was received. As to others, you get men here who say that they think they sold in a year or two before this incident, one or two copies of a fourpenny periodical. Gentlemen I submit to you that the damages are simply nominal. This action was not, as I take it, in the first instance an action for damages. It was an action for an injunction to restrain the defendants from publishing such circulars as that which I have read to you. Upon

the admission that has been made now, and upon the ruling of my Lord, they will be entitled to their injunction, and they will be entitled to that injunction with the costs, undoubtedly of the proceedings which they have had to take in order to obtain it; but I venture to suggest to you that the money damage that they have sustained besides, and in consequence of this circular, is an absolutely inappreciable amount, and that if you listen to and remember the whole of the evidence they have given, you will say that they have not proved that they lost anything through this circular; indeed, their own counsel has himself admitted that the circulation of their paper went up instead of going down afterwards.

[*The Court adjourned until the following day.*]

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SECOND DAY.—SUMMING-UP.

The LORD CHIEF JUSTICE: Gentlemen of the Jury, in this case Henry Alabaster, and Tom Ernest Gatehouse, and Harry Robert Kempe, are the plaintiffs, and the defendants are the Medical Battery Company, Limited. It is an action of libel. It is an action simple enough as far as the law of the case and the facts of the case go, but certainly a good deal out of the common way. The situation of the parties is this:—These gentlemen, who are the plaintiffs, are the proprietors of a periodical, I do not know whether weekly or monthly, but a periodical called the ELECTRICAL REVIEW, which comes out periodically, and which has apparently a considerable circulation—at all events, one great newsagent sells to the extent of over 500 copies, I think, a week, and there are other considerable sales. I suppose that it must be rather largely circulated, because the defendants have thought it worth while to issue 500 circulars, to 500 different vendors of these papers, each of them, of course, or at least probably many of them, selling a good deal more than one copy. It is, therefore, a review which has a considerable circulation. Of Mr. Alabaster and Mr. Gatehouse—we have heard nothing in the case of Mr. Kempe—we have heard from the statement of their counsel, and it has not been contradicted or questioned by Sir Edward Clarke, that they are persons of real ability, real character, and real eminence in their profession of electricians; and one knows that in the present day this great mysterious element, which is diffused throughout the whole universe apparently, has become the subject of great study, and that a great deal of intellect and ability is shown in the prosecution of electrical studies. These gentlemen appear to be, as far as we know, persons prominent in their way, and devoting themselves to the study of this great element, or great power, or whatever it is to be called; and it seems that the Medical Battery Company, Limited, is a company of which Mr. Harness is a leading member, and that he is very much taken up with the sale of electropathic belts, and a variety of other electrical things—amongst others electrical pills, I understand—which is, to my ignorant mind, a new form of electricity. I did not know that it could be confined in a pill and taken internally in that shape; but it seems they have electrical pills. Whether they were that sort of pill which I once heard a great man in the House of Commons describe as pills to cure an earthquake, or not I do not know. But, he added, the man who sold them was a mountebank. I do not know whether these electrical pills at all partake of the nature of those pills, I cannot tell. They have also various needles and all that kind of electrical apparatus, which they prescribe and make use of for the healing of the diseases to which the human flesh is heir. And while they drive a considerable trade undoubtedly, Mr. Alabaster and Mr. Gatehouse are of opinion that this trade is an imposture, and that there is nothing in it—that it is all nonsense; that they are imposing upon a too credulous public; and they have accordingly denounced in no measured terms the absurdity, as they think, of these belts and pills and other things. Whether they have done any injury to the Medical Battery Company I do not know, but they have certainly done their best to expose what, as far as one judges from their articles, which have been read, is a gross system of imposture. Well, so long as they do that according to their notions in the advancement of science, and so long as they do not asperse the private character of persons, and merely quarrel with them on the ground that they are trying to palm off upon the public as real medical and scientific apparatus, what are nothing of the sort, but are mere delusions like the old metallic tractors and a variety of things I am old enough to recollect, which were in vogue, but which have passed away—as long as they confine themselves to that, the press is open, and they have a perfect right to discuss those things as matters of public interest. And of course the Medical Battery Company, Limited, has a perfect right to retort in the same way. They have a right to say that what they do is legitimate and really scientific, and is what honourable and straightforward and honest men and truth telling men can do. They have a perfect right to do that, and they may use strong language in doing it and nobody would complain. But what they have done is this. They have written a letter by their attorney—he has either composed, or at all events, has signed a letter, and Sir Edward Clarke made no technical or formal difficulty, but adopted the letter as the letter of the defendants. He has not denied that for a moment. He would not, of course. It is the letter of the defendants, and this letter they have sent round, at all events, to the extent of 500 copies, because that stands on the evidence of the gentleman who met Mr. Harness in the train, to whom Mr. Harness mentioned that 500 copies of this circular had been sent about to all the newsvendors, or, at least, a great number of the newsvendors in London. It was a very ingenious form of preventing, if possible, the publication, or the dissemination I should rather say than publication, because that has a legal sense, of these stinging articles in the ELECTRICAL REVIEW, because they sent to these different newsvendors a warning, and the warning is the matter which is complained of as the libel. It is certainly a very unusual form, but it may be a very effective one. It is dated "Hatton Garden, London, September 16th, 1892." We have two or three of them, and you can see them if you like. They were printed or lithographed. It says:—"Sir,—Having been consulted by my clients, the Medical Battery Company, Limited, the proprietors of Harness's Electropathic Belt, and also the Electropathic and Zander Institute, of 52, Oxford Street, W., with reference to some malicious libels published in ELECTRICAL REVIEW and a paper called *Science Siftings*"—we have heard nothing about the paper called *Science Siftings*, and we may dismiss that from our notice for the present—"I beg to give you notice that if these, or any future publications containing defamatory articles or paragraphs, are sold or circulated by your firm, my clients will hold you responsible. In the same way, you will be held responsible for the exhibition of any libellous bills or placards. I am, sir, yours obediently, Augustus Fleet." Now that is the libel, and what is said is—and it is for you to judge, because the whole matter now very properly goes to you—it is for you to judge whether, first of all, this is a libel, that is to say, whether it does mean to impute to the plaintiffs dishonourable and malicious conduct, and secondly, if it does so, whether, in the absence of any justification, the damages ought to be nominal, as Sir Edward Clarke has contended, or heavy, as Mr. Finlay has contended. Now, as to its being a libel, I have no right to direct you. That has long since passed away. But in this case I may point out to you that Sir Edward Clarke has admitted that it is, and he addressed you on the footing that he could not deny that this was a libel. That meant to say, of course, that these gentlemen, Messrs. Alabaster and Gatehouse, were pointed at in it, and that the articles in the ELECTRICAL REVIEW, which, upon the face of them, appear to be the attacks of a man of science upon what he believes to be a scientific imposture, were not really written in the interests of truth and science, and were malicious libels, that is to say, imputing to the defendants dishonest and dishonourable conduct, and more than that, that they knew that they were guilty of dishonest and dishonourable conduct, and that they could not really believe anything else, and that it was done for the purpose of repressing and interfering with, and doing damage to the Medical Battery Company. That is what this circular, it is suggested, charges. Now, it is for you to consider the circular, and you shall have it; but I cannot withhold from you that undoubtedly the view of this circular, which Mr. Finlay presented to you, is one which you can perfectly properly take. It is for you to say whether you will take it or no. The circular is undoubtedly capable of that construction. If it is capable of that construction, it is undoubtedly also a libel, and if it is a libel, then, at all events, the plaintiffs are entitled to some damages—because it is not justified; not a word has been put forward in justification of the libel. It is not justified in the pleadings, nor has it been justified by Sir Edward Clarke as to the truth of it. In a libellous sense it is to be taken to be an undefended action as far as the fact of libel goes, and that it does libel the plaintiffs. It is for you to say whether the damages, under these circumstances, ought to be nominal or ought to be heavy, or ought to be whatever you think right between what is nominal and what is exemplary. Damages is a matter emphatically for you, and it is to you entirely I leave that question. Now, you heard a good deal of discussion about the state of the pleadings, and the condition of preparation to discuss the important questions here in which Sir Edward Clarke tells us—and no doubt every word he says is to be relied on—he found himself. There can be no possible blame upon Sir Edward Clarke that having no straw he failed to make bricks. If he had no information in his brief, if he had no witnesses to call, of course he could neither argue nor call witnesses. That is perfectly plain, and, therefore, he himself or those who conducted the case could do nothing else upon my ruling. I do not think Sir Edward Clarke quite said that my ruling took him by surprise. He is, I do not say exactly an old parliamentary hand, but he is an old legal hand, and I think he knew very well which way the ruling must be. If I am wrong I shall be corrected hereafter; but, at all events, the way I put it to you is this:—If this circular is capable of the construction that Sir Edward Clarke has now admitted that it is capable of, and, indeed, which he accepts for the purposes of the trial, that it is libellous in saying that this has not been done *bona fide* for the purpose of exposing a scientific imposture; but it has been done with malicious objects to ruin or injure the company, and to do pecuniary damage to the company, then, undoubtedly, the plaintiffs would have a perfect right to complain of that imputation being made upon them, and to say, "You have no right to say that of us at all; it is a very dishonourable thing to accuse us of; we are electricians; we are really anxious in the cause of truth for science to be properly understood, and properly worked, and it is monstrous that you should tell us that we are a pack of scoundrels—because that is what in effect they say—because we did that which every honourable man and other person who is pursuing science in an honest way, if he had the same materials which we have, and the same knowledge that we have, would be bound to do." That is the way in which it seems to me that they had a perfect right to show by evidence, if they chose to call it, that these electropathic belts, and electropathic pills, and other things were all nonsense; that it was not science, but it was mere quackery, and, because they were accused of dishonest motives—that is admitted—it was perfectly relevant to the enquiry to show not only that they were not negatively actuated by dishonest motives, but positively when the matter came to be understood, they were only doing that which honourable men of science would be bound to do. Therefore, it seemed to me, and seems to me still, and I cannot help thinking that the defendants must have known that, at all events, it was very likely they would be challenged upon the real subject matter of their trade, and would be accused, as Mr. Finlay accused them in certainly very round terms, of a gross imposture, and that, therefore, it was per-

fectly relevant to admit evidence if it had been tendered, or if it became necessary to tender it to show that, for example, hernia, which is a rupture of the intestines, could be cured in that manner. I am not a man of science, but, as I understand it, the intestines are bound together by a sort of cord or band; and after rupture this band gets broken, and the intestines fall abroad. That is very uncomfortable, and if it goes too far, as one knows it has in more than one celebrated case, it is a very dangerous thing. People may die of it. Well, to suppose that you could reconstruct a wall or band of flesh round these loosened intestines by an electropathic belt tied on above them, certainly does seem to be great nonsense. I certaintly cannot help saying it seems so. I am not a man of science, but it strikes one as preposterous nonsense. And when you hear that besides these electropathic belts, there are little pins and things which will convey electrical shocks to the descending hernia, how on earth that could replace the bowels, which is a physical matter, and a surgical matter, and can be done to a certain extent by a truss, which is a very different thing indeed, as you well know—how that could be done by an electropathic belt above the hernia, I confess I do not understand. But then that may be my ignorance At all events, these men have a perfect right to say that it is contrary to the nature of things when you once understand. It is all very well to envelope yourself in electropathic phraseology, I do not know what the words are, but they talked about circulation and the electrical band being made complete, and so forth. Nobody who knows anything about it can for a moment believe, really, that any good would come of that, and yet you take 5 guineas, 15 guineas, 20 guineas, or more than that for these things which cannot possibly be of any kind of use. They do not, in those articles which were read, deny that the electrical treatment of certain diseases may not be very beneficial, or that the cure of certain diseases may not be very helpfully assisted by electricity. We all know that the most scientific people do use electricity, and that, as it is a most powerful, so it is a most valuable agent in many of these things. That is no doubt true, but what they say is that this kind of thing—these belts and needles and pills, and all that, are nonsense and rubbish; that any properly constituted mind would see that they are, and all the more (says Mr. Finlay, and says with a great deal of truth), because they are administered sometimes in these cases of surgical character which nothing but either the knife or the hand, or the instrument of a surgeon, will benefit, but because they are constantly used towards people who by their nervousness are pre-disposed to believe in anything. They do not get help from the legitimate, and ordinary, and every-day practice of medicine or surgery. They find themselves getting no better, perhaps getting rather worse. They are apprehensive, and they are very miserable, and dwell upon their suffering, and make themselves out, perhaps, to be worse than they are; and they catch at the first thing that is presented to them from any quarter which seems likely to give them relief. Therefore, say these gentlemen, it is more important to vindicate science from this spurious imitation being applied to cases of people in weak health, and with their minds and their powers impaired, and who are, therefore, more than other people, likely to be the prey to imposture. We do know, of course, most extraordinary things are believed, and that people persuade themselves that the laws of nature are most inadequately understood by scientific men; and that people who have had no scientific education, and who have not taken the trouble to master the difficulties of the question, know a great deal more about it than those who have. "Therefore," say the plaintiffs, "it is our duty, as we believe, to show up this kind of thing." Well, then the defendants turn upon them and say, "Oh, that is all very fine, but what you do is this: you want to bring down our company, and you are not doing this as men of science; you are doing it for a bye purpose; doing it in a discreditable and unhandsome and untrue way, and we warn everybody against you." Now, as I told you, the case presents a very odd form of libel, and the vindication of it is, to my mind, that sort of ingenious vindication which I do not mean to say Sir Edward Clarke, or any man of his eminence would ever invent, or would ever put forward, but which sometimes, in the stress of weather, the most eminent men are obliged to take refuge under, when it is the only thing they have got to say, and when it is put forward as part of their client's case. Now, what is put forward here is this: It seems that somebody or other brought an action against a boy for selling a paper in which there was a libel, and this went to the Court of Appeal, and the Court of Appeal said, as the Court of Appeal might be expected to say, "This is nonsense the notion of suing a news-vending boy, because he happens to sell a copy of a paper in which there may be some libellous matter, as the publisher of that libel, is utterly foreign to good sense." Lord Esher, I think it was, expressed himself very strongly, and says that if it were so the common law of England would be unjust and absurd, and he would never be a party to holding that anything unjust or absurd on the face of it is part of the common law of England. Therefore, he and Lord Justice Cotton and Lord Justice Bowen, three very eminent men indeed, said that you could not possibly make an innocent vendor of what he neither knew nor had any reason to believe was libellous, liable in an action of libel. They said that in effect, they did not mean to say that if a boy, or anybody, was told beforehand, "That is a libel; take care what you are about," under those circumstances there might not be an action of libel against the person so warned. That again, if I may presume to say so, seems to be excellent good sense, for if you affect a man with notice that what he is going to do is illegal, he cannot complain afterwards if an action is brought against him, because he has had fair notice, and he is generally all right. I do not know whether you have been much in courts, but it generally happens that when you understand the law it is good sense and good reason. Now, that is the case of Emmens *v.* Pottle, which is a case to be found in the books, decided by very eminent men, and absolutely right on the facts upon which it was decided. Now, some ingenious gentleman suggested to them, "Take advantage of Pottle and Emmens, this ELECTRICAL REVIEW has a large circulation, and Pottle and Emmems says that everybody who circulates a libel, if he has been told it is a libel, may have an action brought against him; therefore, issue a circular to all the newsvendors in London, and say that whereas scandalous and malicious libels have appeared in the ELECTRICAL REVIEW—not in this Electrical Review or in that Electrical Review, but in the ELECTRICAL REVIEW generally—if you sell any copy of the ELECTRICAL REVIEW after this, and it turns out that in any corner of that paper there is an aspersion upon anybody we shall bring an action against you, or, at any rate, you will be liable to have an action brought against you." Well, Messrs. W. H. Smith & Son — the Brobdingnagian kings of circulation of these things — even they thought that would be rather a serious thing, so they write to the ELECTRICAL REVIEW, and say, "We have had this letter, what are we to do?" "Oh," say these gentlemen, "What are you to do? Why, we will guarantee you; there is your indemnity, go on." What did Messrs. W. H. Smith & Son do? They went on, and treated the circular with utter scorn. Somebody else went to the plaintiffs, and said, "Here, I have got this letter; I am a newsvendor; I am not a very big man,"—and there was a young lady who was called—a newsvendor who was not in a large way, and I dare say, not very rich, and she was alarmed at this Electropathic Belt Company coming down upon her, and saying, "Now, if you sell another copy of the ELECTRICAL REVIEW you will have an action against you." And so they go one after the other to the plaintiffs, and the plaintiffs say, "We will guarantee you; we undertake to pay all costs, charges and expenses that may come upon you, if any do ever come for selling the ELECTRICAL REVIEW," and the sale goes on. The sale of it has been a little impeded, perhaps, but it is not perhaps very much. I think Mr. Finlay did not put it so much upon the money loss as upon the indignity of the attack on the character of the managers of a perfectly respectable paper, written in the interests of science, and written by people who know what they are writing, and written for a good purpose. That is the shape which this libel has taken, and that is the sort of defence. Now, I do not mean to say that Pottle *v.* Emmens has nothing whatever to do with the case, because in the judgment of the Lords Justices they all have said it must not be taken that this applies, if you give distinct notice beforehand, to a man that he is selling a libel. If he does it after that, Pottle *v.* Emmens will not apply. It never was intended, I am quite convinced, by the Lords Justices to say that by sending broadcast circulars all over London, and saying, "Take care what you are about," that perfectly innocent persons who knew nothing about electricity, or who knew nothing about the quarrels between the Belt Company and these gentlemen—when I say the quarrels, I mean the differences—should be made defendants in libel actions, nor probably would they have done anything of the sort. The defendants would never have brought an action against the young lady for selling a single copy of the ELECTRICAL REVIEW, because if they had done so, the ELECTRICAL REVIEW undoubtedly would have defended the action, and then all this matter which we have not had—I do not know whether to say the pleasure or the pain of listening to for a good length of time, but which has been hinted at in this case, would have had to come out, and therefore it is excessively unlikely that they would have done anything of the sort; but still that is the sort of defence that has been put forward. Now you must judge, now that we have to try the question how it arose, whether that is at all a *bona fide* explanation of the issue of this circular. If it is not a *bona fide* explanation—that is for you entirely—then it remains that these people have published this—they have asserted that, as far as I can presume to judge, well written, clever, well reasoned articles on the subject of electricity, denouncing these things, no doubt, as electrical and scientific impostures, were not written, as they appear to have been written, in the interests of science, but were written by these gentlemen, apparently of high character and ability, for the purpose of ruining a company with which they do not happen to be connected, and which they did not like. That is a very serious imputation. Then when they are confronted, the plaintiffs say, "Well, what we propose to do is to show that these electrical articles which we have written are genuine articles; they are articles founded upon scientific truth; they are articles which we have written in the interests of truth; they are articles written to expose an imposture, and which we are prepared to show is an imposture." When the defendants are confronted with that, Sir Edward Clarke says, "I have no instructions, I am not prepared to go into this case; therefore I admit that there must be a verdict against me, and there must be a verdict against me for something or other." Now, gentlemen, that is the case. What is it to be? It is for you to say. There are three alternatives. If you believe Mr. Finlay, and think very badly indeed of these defendants, the damages ought to be exemplary. If you believe Sir Edward Clark and his view of the defendants, the damages ought to be, I will not say nominal, but they ought to be very small indeed; and there is a possible third view that, although they have not done apparently—I will not say any damage, or damage to the extent of a shilling or two, but no serious or substantial pecuniary damage to the plaintiffs—they have aspersed them, and put them to a deal of trouble and annoyance, and made, to those who understood what the circular really meant—and it was circulated very widely throughout London—what was a real attack on the character of these gentlemen, and then there should be something, not exemplary, perhaps, nothing that should be vindictive, but something substantial. I say nothing exemplary or vindictive, because, with great judgment, Sir Edward Clarke has shrunk from the enquiry as to whether these electropathic belts, and machines, and pills, and so forth, are scientific. He says, "I am not prepared for that; I am taken by surprise; I have not got the witnesses here, and I am not ready for that; I have brought another action." He has brought another action. It is not yet in issue. Whether that action will ever be tried or not remains in the womb of time. Nobody can be quite certain that the

action will be brought. It may be or it may not, but that is entirely in the plaintiff's hands, unless the defendants are foolish enough to what they call, rule them to go on; that is, to force them to go on whether they like or not, which very seldom ends in any good. As a rule, a plaintiff in an action has the conduct of the action, and as a rule, at the last moment, the plaintiff can say, "I do not choose to go on any further; I will pay the expenses of the pleadings and so forth, and I will drop the action." Therefore whether this matter will ever be tested before a court of law is at least doubtful. It may come on, but at any rate there is nothing to compel the defendants to go on with the action which they say they have brought against the plaintiffs. Now that being the state of things, what is the damage? That is entirely for you. There must be a verdict for the plaintiffs, and it must be accompanied by such damages as you think right, taking into account the remarks I have made to you, so far as you think them good sense. If you do not think them good sense, disregard them. If you do, pay as much attention to them as you think they deserve.

Mr. GERMAINE: Would your Lordship allow me to make an observation with reference to what has been called in the case "electrical pills." Your Lordship referred to that remark made by my friend, Mr. Finlay, but of course there was no evidence as to the sale of these pills by the defendants.

The LORD CHIEF JUSTICE: No, it is only part of what they say. They read an advertisement which sounded all right about the electrical pills.

Mr. GERMAINE: There were no pills referred to in the advertisement.

The LORD CHIEF JUSTICE: In the book there was.

Mr. GERMAINE: It was only on the opening statement of counsel.

The LORD CHIEF JUSTICE: In the book?

Mr. GERMAINE: No, my Lord, it is not in the book. There is nothing about pills whatever. I am instructed there is absolutely nothing about pills. I am inclined to think that the pills were in the fertile imagination of my friend, Mr. Finlay.

The LORD CHIEF JUSTICE: Then you must not understand, gentlemen, that the pills are, what the doctors call, exhibited in this case.

Mr. WALTON: I think it is right to say that my friend Mr. Finlay was opening the evidence, and part of the evidence was——

The LORD CHIEF JUSTICE: You have evidence about pills?

Mr. WALTON: Yes, my Lord. We had the testimony of a witness who had purchased these pills.

The LORD CHIEF JUSTICE: I do not know what he may have said. What the pills may have produced we do not know. I think it is safer to disregard the pills, and stick to the belts and needles and those things. I am very much obliged to you, Mr. Germaine. I assure you I thought it was all in the advertisement.

[*The Jury consulted for a few minutes.*]

The ASSOCIATE: Are you are agreed, gentlemen?

The FOREMAN: Yes.

The ASSOCIATE: What amount do you find for the plaintiff?

The FOREMAN: £1,000. (Applause.)

Mr. WALTON: I apply for judgment for the plaintiffs, and for a certificate for a special jury.

The LORD CHIEF JUSTICE: Yes, certainly.

Mr. WALTON: There was a matter left for your Lordship's decision connected with the examination of a witness. An order was made for the examination of a witness, and the costs of that examination were left to the judge at the trial. I ask for those costs.

The LORD CHIEF JUSTICE: You did not call him.

Mr. WALTON: No, he was too ill to come. We took his evidence on commission.

The LORD CHIEF JUSTICE: You did not put it in.

Mr. WALTON: No.

The LORD CHIEF JUSTICE: I think you have got quite enough, Mr. Walton.

Mr. WALTON: Of course we had the evidence here, and we should have put it in.

The LORD CHIEF JUSTICE: Yes, I know; but Sir Edward Clarke, with great judgment, relieved you from the necessity of calling him.

Mr. WALTON: He did, but your Lordship will see the cost was incurred by procuring the deposition.

The LORD CHIEF JUSTICE: I do not know why he should burden himself with the necessity of paying for it.

Mr. WALTON: In any case we had the deposition which was procured by incurring these costs.

The LORD CHIEF JUSTICE: You have got a verdict which I shall not move one finger to disturb, you may depend upon it; and you have got your certificate, and you have got your judgment.

Mr. GERMAINE: I ask your Lordship for a stay of execution.

The LORD CHIEF JUSTICE: No.

Mr. GERMAINE: I ask if your Lordship will give us a stay for 14 days, provided we serve notice of appeal within that time.

The LORD CHIEF JUSTICE: No, certainly not. I shall not interfere in any way.

Mr. GERMAINE: I only ask your Lordship under the circumstances of the case, the damages being, I should submit to your Lordship, unreasonable upon the evidence.

The LORD CHIEF JUSTICE: I cannot say that.

Mr. GERMAINE: I ask that there should be a stay of execution pending an appeal.

The LORD CHIEF JUSTICE: I cannot say that. A man is a very bad judge of himself; but I do not think I aggravated the damages at all. I think I left the matter rather too favourably for you, perhaps.

Mr. GERMAINE: There is only one other point I should like to submit, and that is on the question of the admissibility of this evidence.

The LORD CHIEF JUSTICE: That I cannot help.

Mr. GERMAINE: No.

The LORD CHIEF JUSTICE: I ruled that firmly and determinately, and I think I am right, but I may be wrong about that. I am very often instructed; I am not too old to learn.

M. GERMAINE: No doubt your lordship is right, but at the same time I think my clients would like to have the opinion of the Court of Appeal on such a novel action.

The LORD CHIEF JUSTICE: I have no objection.

Mr. GERMAINE: Then, in view of that will your lordship stay execution?

The LORD CHIEF JUSTICE: I cannot do anything that implies the slightest desire to help you. I leave you where you are. I cannot prevent your appealing, of course, and I do not wish to.

Mr. GERMAINE: There is only one observation I should like to make and that is this: I did not want to make it before the jury gave their verdict. In the course of your Lordship's summing up, you told the jury that the defendants must have known that they would be challenged in substance as regards their appliances, and ought to have been prepared with their evidence.

The LORD CHIEF JUSTICE: I said I thought they must, and I say so still.

Mr. GERMAINE: I am only anxious to take upon myself the onus of preventing them in that direction.

The LORD CHIEF JUSTICE: No; I cannot let you do that, at all events. A generous man very often does that. Happily, Mr. Germaine, there is no action against a barrister.

Mr. GERMAINE: I am very glad to know that.

The LORD CHIEF JUSTICE: Besides, you advise to the best of your judgment; I decide to the best of mine.

### APPLICATION TO STAY EXECUTION.

Yesterday, Counsel, on behalf of the defendant in the case, applied to the Master of the Rolls and Lord Justice Lindley, sitting in the Court of Appeal, asking for stay of execution in the case until they could give notice of appeal from the judgment for to-morrow, on the ground that the damages were excessive, and the learned judge was wrong in his summing up on a point of law. Within an hour of the judgment (he said) the managing clerk of the plaintiff's solicitor, demanded to be paid the £1,000, and it had been handed over accordingly to plaintiffs' solicitor.

The MASTER OF THE ROLLS: Without any terms?

The learned counsel replied that he believed so.

LORD JUSTICE LINDLEY: Then execution cannot be issued except for costs, and surely they can't be taxed before to-morrow.

The MASTER OF THE ROLLS: If the money had been paid into Court it would have been different; but it having been paid over, I never heard of the Court interfering to get it back again, as you suggest. Your application as to the £1,000 is childish, and as to costs it is unnecessary.

COUNSEL: May I ask for an order that the £1,000 shall not be dealt with until after the hearing to-morrow; it is only 24 hours.

The MASTER OF THE ROLLS: You want us to do something illegal for only 24 hours, but I don't think we should be comfortable even for that time if we consented.

LORD JUSTICE LINDLEY: We can't help you; you must give the ordinary notice.

## NOTES.

**The Goebel Defence.**—In our last issue we were able to announce the granting of an injunction by Judge Colt against the Beacon Vacuum Pump Company by reason of the Goebel evidence not having been sufficiently conclusive, and in our present issue we reproduce the final part of the Judge's opinion. The first portion of the judgment recapitulates the past history of the suits and appeals in which the Edison patent was at stake, and then dealt with a few instanced where a patent, which had been upheld in the law courts, had been subsequently revoked by new evidence of a markedly conclusive character. The state of the incandescent lamp art prior to Edison's patent was next reviewed, then Goebel's story, together with the more important affidavits supporting it, and finally the complainants' affidavits in rebuttal. All this we have entered into in our late issues and it will not be necessary to repeat it. Then follows the conclusion arrived at, which we reprint. It is clear all through that the Judge regarded the story with considerable doubt and his remarks in reference to the lamp exhibit No. 4 are extremely pertinent and convincing. The fact as to Goebel's application for three patents was also not without weight on the Judge's mind, and so were the dealings and negotiations with various companies' agents and company promotors. Our readers could see from our remarks in the last issue on which side we inclined and we now fully agree with Judge Colt's remarks as regards the story.

The only part of the judgment with which we are not in full accord is that where the three fiddle-bow lamp exhibits are discussed and the conclusion arrived at that, setting aside the question of their genuineness, they were not practicable lamps, not as practicable in fact as those of other workers in the art prior to Edison, and therefore they were not anticipations. We contend that to transform such a device into a practicable incandescent lamp needed merely familiarity with detail, and perseverance; and we cannot help contending that Mr. Swan's undeniably genuine lamp is an anticipation of Edison's patent in England, for the same reason. We give illustrations of the two principal exhibits in the cases.

**Blackpool Electric Lighting.**—A lengthy letter appeared in the *Blackpool Times* last Wednesday week, in which is discussed the probable cost of electric lighting in Blackpool.

**Burgess Electric Lighting.**—The Local Board have decided to make enquiries as to the best means of establishing electric lighting works at Burgess.

**Derby Electric Lighting.**—A Local Government Board enquiry was held at Derby Guildhall, last week, regarding the application of the Corporation to borrow £50,000 for electric lighting and other purposes; £30,000 of this sum is for electric lighting. The estimated annual cost of the electric lighting is £2,767, exclusive of the amount necessary to repay the loan.

**Colchester Electric Lighting.**—At last week's Town Council meeting it was reported that the provisional order had been obtained, with some small alterations.

**Bagshot Mansion Electric Lighting.**—A portion of the residence of the Duke and Duchess of Connaught at Bagshot Park is being installed with the electric Light.

**Lectures.**—Mr. Alexander Siemens delivered a lecture on "Electricity as a Motor Power for Factories," before the Birmingham Association of Mechanical Engineers, at the Grand Hotel, Colmore Row, on Saturday evening last.

**Hertford Electric Lighting.**—The Electric Lighting Committee have prepared a report in favour of a scheme for electric lighting, which has been considered by the general committee of the corporation, consisting of the whole of the members of that body. A council meeting was to be held yesterday to consider the matter.

**Hampstead Electric Lighting.**—Mr. W. H. Preece has presented his plans and specifications for the erection of an electric lighting station in the Stoneyard in the Finchley Road, and for the lighting of the compulsory area fixed by the provisional order obtained by the vestry. The plans, &c., have been referred to a sub-committee for consideration and report.

**Electrical Workshops at Chatham.**—In the Naval Estimates for 1893 the Government set apart £2,050 for the erection of electrical workshops at Chatham.

**The Royal Society.**—The following paper was down for reading last evening:—"The Electrolysis of Steam," by Prof. J. J. Thomson, F.R.S.

**Coventry Electric Tramways.**—There was much discussion at last week's meeting of the City Council regarding the report of the General Works Committee relating to the agreement with Mr. Graff Baker on the subject of the equipment of the electric tramways. It was stated that the committee were moving as fast as possible in the matter.

**Ilford Electric Lighting.**—A report received from the expert of the Brush Company upon the lighting of Ilford with electricity, recommends that they should start with two sets of electric generating plant, and gives figures and statistics with the view of showing that electricity could be obtained at a lower price than gas. There has also been received a tender from the Brush Company. The subject has been referred to the Lighting Committee for consideration.

**Swansea Electric Lighting.**—Electrical engineers are engaged in laying down a supplementary electric light installation at Craig-y-nos, which is estimated to cost £250.

**Dover Electric Lighting.**—According to the report at the meeting of the Town Council regarding the electric light, the agreement appears, says the *Dover Standard*, to be as far off settlement as ever—and the electric light still farther.

**Hamburg Electric Lighting.**—In our last issue we published an article on this subject, which we stated in error was from our own correspondent. The article was a translation from the *Hamburgher Correspondent*, and was written for that journal by Dr. N. Hertz.

**Salford Electric Lighting.**—At last week's meeting of the Town Council it was stated that sufficient promises had been received from residents in the district which was to be lighted by electricity, to justify them in proceeding with an installation, which would cost £30,000.

**O.S.A.**—A very successful *soirée* was held in connection with this Association on March 3rd at the Central Institution, when Mr. Clinton T. Dent, the well-known Alpine climber, gave a most interesting lecture on "Mountaincraft," illustrated by very fine mountain slides from photographs by Mr. Dent himself, Prof. Donkin, and others. The dance in connection with the Association takes place on March 17th.

**Obituary.**—We regret to learn that Mr. Jesse W. Howard, well known to many electricians and to members of the B.A. through his connection with the graphophone when the apparatus was exhibited at the Bath meeting, died on March 2nd, in the United States, at the early age of 25 years.

## CONTRACTS OPEN.

**Barberton (South Africa).**—May 3rd. For the supply of machinery, electrical generating plant, &c., for the Moodies Gold Mining and Exploration Company, Limited. Further particulars from the secretary, 8, Old Jewry, E.C.

**Cassel.**—March 13th. For the supply and fixing of electrical signalling apparatus at Wülfel station, for the Prussian Royal Railways. Further particulars from the manager of stores, Cassel, Germany.

**Dewsbury,** April 8th.—The time for sending in tenders for electric lighting the borough has been extended from March 25th (as stated in our last issue) to April 8th. See our advertisement pages.

**Hanley (Staffordshire).**—March 13th. Electricity generating works (Contract No. 3) for the corporation. Further particulars from Mr. J. Lobley, borough engineer, Hanley.

**Manchester.**—March 21st. For the supply of signal stores (contract 56), telegraph materials (contract 57), for the Manchester, Sheffield and Lincolnshire Railway Company. Further particulars from Mr. A. W. Longden, Junction Street Mills, London Road, Manchester.

## BUSINESS NOTICES, &c.

**The United Electrical Engineering Company, Limited.**—A general meeting of the members of the abovenamed company will be held at A. S. Gedge's office, 3, Great James Street, Bedford Row, London, W.C., on April 5th, 1893, at twelve o'clock noon, for the purpose of having an account laid before them, showing the manner in which the winding up has been conducted, and the property of the company disposed of, and of hearing any explanation that may be given by the liquidators.

**Presentation.**—An interesting ceremony took place at the Grand Hotel, Birmingham, on Tuesday night, the 21st ult., when the chief officers of the Central Tramways Company entertained the managing director, Mr. W. J. Carruthers-Wain, Assoc.Inst. C.E., and representatives of each branch of the service to dinner. Advantage was then taken of the occasion to present him with a magnificent punchbowl, which had been spontaneously subscribed for by the men in the different departments.

**Derry Electric Lighting.**—At a meeting of the Lighting Committee of the Derry Corporation, held last week, Mr. Mathew M'Clelland was provisionally declared contractor for the erection of the central station in connection with the electric light scheme.

**The Metropolitan Electric Supply Company's New Station.**—At the invitation of Sir John Pender, the members of the Paddington Vestry and representatives of the press last Friday visited the Amberley Road (St. Peter's Wharf), new electric supply station of the Metropolitan Electric Supply Company. It is worth mentioning here that the total horse-power at the various stations of the company amounts to about 8,000, and the present supply is equivalent to a connection of 130,000 8-C.P. lamps, which is greater than those of any similar undertaking in the United Kingdom. The station which forms the latest addition to the company's works is situated in Amberley Road, Harrow Road, and being erected alongside the canal possesses the advantages of both road and water access. Before the erection of this station the Metropolitan Company were running only four generating stations, but to these the Amberley Road station has been added to meet the requirements of the Parish of Paddington. It has been designed with every provision for future extension, and as the demand for current is now very large there is every probability that in a short time additional plant will be required. The buildings consist of boiler house with coal store fronting the canal; engine and dynamo room; and suitable offices and store rooms fronting the road, the upper floors over the offices being planned for the accommodation of the staff required in working the station. The buildings were designed and erected by the company's staff, Mr. Mark Judge, F.R.I.B.A., being the consulting architect. The building work proceeded without interruption through the period of the recent strikes in the building trade. Five large horizontal engines have been erected, each driving a Kapp alternating dynamo by ropes. The smoothness of the running is most noticeable, special means having been adopted to obviate the noise and hum frequently caused by such machinery. The contractors for the plant were Messrs. Johnson & Phillips, of Charlton, the engines and boilers being constructed by Messrs. Hornsby, of Grantham. The two smaller exciter engines were supplied by Messrs. Allen, of Lambeth. The mains, which are insulated with vulcanised India-rubber, and manufactured by the India-rubber and Gutta Percha Company, Limited, of Silvertown, are brought into the engine room through subways, and are connected to a switchboard constructed of marble so as to avoid leakage. Every facility is provided for making examinations or disconnections when required. The method of laying these mains is one of considerable interest. All jointing is avoided as far as practicable, and, as the mains form complete rings, customers are provided with a duplicate supply, and can therefore be connected without interfering with the general supply. In declaring the station open, Sir John Pender (who is chairman of the company), paid a tribute to the "old hands" who had established the company, more especially Sir George Elliot who, he said, was one of the earliest hands in the development of electricity. The chairman also said that when the consumption reached a certain amount they would be enabled to reduce the charge per unit, but in the meantime the shareholders would have to suffer. At the close of his remarks the company present proceeded to inspect the new works, after which their attention was directed to a small exhibition of electrical cooking and warming apparatus. We understand that arrangements are being made for these appliances to be on permanent exhibition at the company's several stations. The display on the present occasion was very kindly lent by Messrs. Crompton & Co., Limited.

**Woodhouse & Rawson.**—We understand that Messrs. Woodhouse & Rawson, United, Limited, have recently carried out the following installations: Through their Dublin agency the premises of Mr. James Fox, College Green and Grafton Street; the Indian Tea Company, Grafton Street; Mr. W. Sexton, Grafton Street; Mr. Lucas's Hairdressing Rooms, Suffolk Street; Mr. Humphrey, Dame Street; Mr. Diamond, Parliament Street; Mr. Mooney's Chambers, Fleet Street. They are also re-organising and greatly extending the lighting of the Stephen's Green Club (originally put up by a local firm), and are at present engaged on various alterations and additions to the Kildare Club installation. Through their Bradford branch:—The Borough Surveyor's Office, Huddersfield; F. C. Foster, Esq., Queensbury; H. A. Foster, Esq., Queensbury; John Foster, Esq., Egton; the Harrogate Hydropathic Establishment; G. A. Carr and Co., Grimsby; J. H. Haggas, Esq., Oakworth; Joseph Nicholson, Esq., Leeds; Manfield & Sons, Hull; C. F. Tetley, Esq., Leeds; Yorkshire House-to-House, Leeds, wiring of Central Station; E. Holmes, Esq., Bradford; the warehouses of Messrs. Heymann and Alexander, Bradford; the offices of Messrs. Neill & Broadbent, Bradford; the Low Moor Iron Company's furnaces installation. Through their London office:—Messrs. Lenders & Co.; Angier Brothers; Bandall & Co.; Holzapfelsn Composition Company; premises of the *Yachtsman*; Major-General Fremantle; W. B. Buer, Esq.; electric apparatus for pumping station, Crossness, for the London County Council. In addition to these they have also in hand installations for large country mansions near Manchester and Glasgow.

**Birmingham Telegraph Factory.**—In the Chancery Division last Friday, Mr. Jenkins applied to Mr. Justice Kekewich on behalf of Messrs. Fowler, Lancaster & Co., for the appointment of a receiver in the Birmingham Telegraph Factory, Limited, now in liquidation. His clients were debenture holders for £3,000. The company went into voluntary liquidation on February 18th last. His Lordship allowed the person appointed by the plaintiffs to act as receiver until Tuesday week.

**Private Telephone Installation.**—Mr. A. J. Crompton, of the Scarisbrick Hotel, Southport, has instructed Mr. Walter Leake, consulting electrical engineer, 30, Victoria Buildings, Manchester, to superintend the erection of a complete telephone, bell, and speaking tube system on the above premises. Messrs. Maunsell, Mercier & Co., of Deansgate, Manchester, are carrying out the work to Mr. Leake's plans and specifications.

**Catalogues.**—A new illustrated catalogue, dated December, 1892, has been brought out by Messrs. Johnson and Phillips. We have no hesitation in remarking that this book is one of the first class; it deals with all descriptions of electric light apparatus. Considerable credit is due to Messrs. Johnson and Phillips for the way the book has been prepared, and also for the tasteful manner in which information and blocks have been set out. On the title page there are gilt illustrations of the two gold medals awarded to the firm at the Crystal Palace Exhibitions of 1882 and 1892. A contents page, followed by a more detailed index, is in the front of the book. Dynamo-electric machines, which are very clearly and profusely illustrated, are also fully particularised, as are also alternating current apparatus, storage batteries, and accumulators and accessories for ditto, measuring instruments, cables and wires, insulators (of which there are a large number of illustrations), arc lamps and accessories, incandescent lamps and fittings, and a great number of switches, cut-outs and other electric light accessories. Some very useful comparative tables of wire gauge equivalents, in which the equivalents are given in decimals of an inch, and equivalents in millimetres of the Imperial and Birmingham wire gauges, also tables of the weights and resistances of pure copper wires, decimal equivalents of inches, feet and yards, electric light compared with gas, oil, and candles, and other very interesting tables of information. At the end of the book there is a code for telegrams for customers' convenience. Among the illustrations in the catalogue there are several extra good ones calling for special notice, *i.e.*, photograph of the Regent's Park central station, London, photograph of Tottenham Court Road showing Brockie-Pell lamps erected; of the latter there are two full page photograph illustrations. Not only does this catalogue go into general description of the various apparatus and articles, but wherever possible minute particulars in regard to price are set down. We have much pleasure in recommending the book as well worth the perusal of the electrical trade generally. It is a first-class piece of work, both in regard to printing and catalogue compilation.

**New Closed Circuit Transformer.**—A small closed-circuit transformer has lately been designed by Sir David Salomons, Bart., and Mr. L. Pyke, for use in connection with supply companies' alternating current circuits, and intended to raise a normal E.M.F. of 100 volts to 5,000 volts. The quantity of current which it furnishes at this potential is sufficient to very brilliantly illuminate vacuum tubes. Indeed, so bright are they, that a photograph was taken solely by the light of the tubes suspended from the secondary terminals. The transformer is provided with an attachment in the form of the usual "B.C." lampholder, the primary winding being connected to the brass contact plates—a great convenience—the connection being made and the transformer securely held in any conveniently placed lamp holder. As may be supposed, Messrs. Pyke, Harris & Company, Limited, are manufacturing these articles, but we understand that arrangements have been made that they should be obtained from the General Electric Company, Limited, who are the sole agents. We understand that Sir David Salomons intends proceeding further in the direction, and will shortly introduce a combination similar to the above, but with the vacuum tubes permanently fixed thereon, and arranged to form an ornamental illuminating device which will probably be used in conservatories and other places where beauty is of more importance than a very brilliant illumination.

**Leicester Electric Lighting.**—The following letter appeared last week in the *Leicester Daily Post*:—"I write to put before the ratepayers of Leicester a few particulars as to the treatment received by my company's tender at the hands of your Corporation Gas Committee and engineer. We observe from your report of a meeting held on Monday, the 20th ult., that the tender proposed to be accepted amounts to £27,000, exclusive of the buildings. Our original tender for rope driven dynamos and vertical engines amounted, without buildings, to £20,310; and for slow speed direct coupled dynamos, with horizontal engines, our price was £23,620, being nearly £3,500 lower than the tender proposed to be accepted. Further than this, our tender price included opening and making good the streets after laying mains. The scheme we proposed was, we feel sure, a thoroughly good, sound, and workmanlike one, and in every way as good as could be obtained from any other contractors. We are not inexperienced, as your committee well know, and we need only refer to the fact that the Commissioners of Sewers of the City of London awarded the contract for the most important section of the City of London to us to show that we are responsible and fit to be trusted with the erection of the central station in Leicester. We observe that canvassing in Leicester is to disqualify any contractor, and as no protest to the Gas Committee would be likely to reach the ratepayers, we ask you to give publicity to this letter.—The Laing, Wharton, and Down Construction Syndicate, Limited, James Devonshire, Manager and Secretary."

**Newspaper Printing by Electricity.**—The printing department of the *Dundee Advertiser* and *Evening Telegraph* has been equipped with an electric motor. Last Saturday's issue of the *Evening Telegraph* was successfully printed by electric power, being the first newspaper in Scotland to be produced in this way. Last Monday's *Advertiser* would also have been printed by electricity, but the Dundee Gas Commissioners electric installation is not yet in complete working order, and cannot supply electricity in the early hours of the morning, when this journal goes to press. In the office of the *Dundee Advertiser* steam, water, and gas engines have been successively employed, and in experimenting with electricity we are in a position to judge the relative merits of this new source of power. The electric motor was made by Messrs. Mather & Platt, Manchester, and it has been fitted by Messrs. Lowdon Brothers, electricians, Dundee.

**Southampton Docks Electric Lighting.**—The London and South Western directors' scheme for dock development and improvement at Southampton comprises an extensive installation of the electric light. Tenders were invited from the leading firms, and the tender of Messrs. Crompton & Co., London, was accepted. The whole of the Empress Dock, the dock extension, the French Quays, and the dry docks, as well as the two entrances to the dock premises, and the carriage approach from the entrance to the Empress Dock is to be lighted by means of the newest type of arc lamps invented. The sheds contiguous to the above area are to be lighted by means of incandescent lamps.

**Camberwell Electric Lighting.**—The General Purposes Committee of the Vestry of Camberwell have appointed Mr. E. Manville, of Messrs. Kincaid, Waller & Manville, 29, Great George Street, Westminster, to advise them as to how best to introduce electrical power into Camberwell.

## CITY NOTES.

### Woodhouse and Rawson.

RECEPTION OF THE INVESTIGATING COMMITTEE'S REPORT.

A MEETING of the shareholders in Woodhouse and Rawson United, Limited, was held on Tuesday, the 7th inst., at the Cannon Street Hotel, for the purpose of receiving and considering the report of the committee of investigation, which it will be remembered was appointed at the general meeting in November. Mr. W. S. Squire, the chairman of the committee, took the chair.

The CHAIRMAN said it was suggested by some that the duties of the committee were confined to investigating the present condition and future prospects of the company, and that any inquiry as to what had been done in the past was outside their province; that, however, was not the view taken by the committee, because it was only by a study of the past that a forecast of the future could be arrived at. The committee, therefore, had gone through the accounts of the first two years as well as those of the third year, and had embodied their views in a report. The report stated that the company was formed in 1889 by the purchase of several companies from Woodhouse and Rawson, Limited, who were the vendors, for £269,000. The vendors stated in the original prospectus that they had been carrying on business very profitably, and as an inducement for the public to subscribe, they undertook to guarantee the new company 15 per cent. on the ordinary shares for three years, and to deposit £75,000 with them as a guarantee. The way in which that was done was simply to leave £75,009 of the purchase money unpaid. At the end of the first financial year the annual report showed a net profit of £61,085, out of which dividends were paid and £16,335 carried forward. There was no explanation of how these profits were arrived at, and the committee had to report that a considerable portion of these profits consisted of very doubtful items, which were certainly not legitimate trading profits. The first of these items was £25,000, an amount received from the Kensington stores for leasing to them the front portion of the Cadby Hall property. The second item related to Jensen's bell, which was purchased for £2,050, and straightway entered in the books at £3,920, the difference being treated as profit. The directors also took credit as a business profit for £4,050 premiums received on their issue of shares. The next item was £37,240, the balance for promoting the Okonite Company. This was entered in the books on the last day of the financial year (June 30th, 1890), but the prospectus was only issued on the first day of the next financial year, and it must have been some considerable time before it could be seen whether there was any profit. Not a penny of the profit accrued in cash—it was all in bonds and shares. The committee were of opinion that these four items (amounting to £68,160), should have been carried to a suspense account. One result of the profits being increased in this way was to entitle the managing director to a large commission. As a fact, the managing director received in respect of this year's trading a commission of £13,775, of which more than £10,000 was in cash. Secondly, he was the liquidator of Woodhouse and Rawson, Limited, the vendor company, in which he was largely interested. It would benefit those interested in that company to get the guarantee fund of £75,000 out of jeopardy as soon as possible. Accordingly, two months after the issue of this balance-sheet the shareholders were asked by the directors to consent to the repayment, as the directors had "a confident assurance that the rate of dividend would be maintained." The committee were satisfied that if the shareholders had known in what way the profits of the first year had been arrived at they would not have parted with the guarantee. While the £75,000 remained a guarantee fund it bore no interest. By the way in which it was repaid it was made to come before both the ordinary and preference shares; it at once began to bear 5½ per cent. interest, and had nearly doubled the debenture debt of the company. The large amount of this debenture debt made it so difficult to reconstruct and save the company. With regard to the year ending July 31st, 1890, the £12,000 rebate on the £75 was placed to the credit of profit and loss; so that a transaction which was really a source of heavy loss was actually claimed to have resulted in a net profit of £12,000. The next item of profit was £14,975 appreciation of founders' shares in the Phœnix Trust Company. Twenty-five founders' shares in this company were said to have been purchased for £25, and were then entered in the books of Woodhouse and Rawson United, Limited, as being worth £15,000, the difference (£14,975) being considered as the profit. The Phœnix Trust Company had gone into liquidation, and its shares were worthless. Woodhouse and Rawson United, Limited, formed a company called the Epstein Accumulator Company, with a nominal capital of £100,000. Of this, shares worth nominally £70,000 were allotted, 55 per cent. to Woodhouse and Rawson United, Limited, and 45 per cent. to Mr. Epstein. Woodhouse and Rawson United and Epstein gave 10 per cent. of their shares to the Phœnix Trust Company. The whole of this transaction was on paper, yet Woodhouse and Rawson United, Limited, took credit for £31,600 net profit, and that amount was brought into the profit and loss account as divisible profits. The value of the Epstein Accumulator Company's shares might be great or nothing; it would be determined in future. Another item of profit was £15,188, being the profit on the issue of French and Austrian Elmore companies; but these were all in paper, and practically unsaleable. Then the value of the Kidsgrove works was raised to the extent of £2,640, though these works had been a source of loss to the extent of £40,000 or £45,000, and the Kensington works were appreciated £1,000. These items came to £81,233, while the net profits claimed for the year amounted to no more than £51,439, including these items. The committee were of opinion that in these two years the profits had been apparent rather than real, and that the dividends ought to have been paid out of the guarantee fund. In the third year the inevitable Nemesis began to overtake the company. The losses at Kidsgrove and elsewhere, and the disastrous effects of the attempts to infringe other people's patents, had to be confessed. The unsaleable securities had to be written down, and the opportunities for showing apparent profits were exhausted. The result was a heavy loss—great, but apparently understated. In the very month in which the directors induced the shareholders to assent to the repayment of the £75,000, they were borrowing money at 10 and 12 per cent. to pay the dividends, and at this very time the account of the managing director with the company was overdrawn more than £20,000. On January 15th, £9,500 was borrowed from Mr. Wood at 10 per cent. interest; if not repaid by April 15th, a fine of £500 was to be paid. It was not repaid, so that this, for the three months, amounts to an interest at the rate of 30 per cent. per annum. At this time the managing director's debt to the company was £20,833, for which he was charged 6 per cent. per annum. The committee found that on December 12th last, a few days before the general meeting, the directors agreed, by deed, to cancel the debt of the managing director, on his giving £18,480, the balance then due, in second debenture stock. The deed was attested by Sir Rawson Rawson (the father of the managing director) and Mr. S. Pope, Q.C. Those debentures were to be accepted at par price, though their market value was not half that, and not saleable at this price. The amount was due in cash, and not in depreciated paper. The report went on: "The company was put forth to the public as an electrical manufacturing company. Your committee find that the manufacturing department has been utterly neglected and shamefully mismanaged, while the managing director has devoted his energy to hunting financial Will-o'-the-Wisps. As a consequence, the manufacturing carried on by the company has not been profitable, and, probably, for the same cause, none of the branches or agencies of the company have shown a profit. Your committee have visited the Manchester, the Kidsgrove, and the Kensington works. The Kidsgrove purchase they regard as particularly unfortunate. The purchase was decided on hastily, without proper professional advice, and the price paid was enormously in excess of its value. The plant is, for the most part, antiquated, the situation unsuitable; the assets taken over turned out bad, and the contracts then on hand have resulted in a heavy loss. Your committee have endeavoured to arrive at the present financial position of the company, computed on a rational basis. The securities, which stood at July 31st last at the nominal value of £101,847, being for the most part unsaleable at present, they have cut down to £25,000. The goodwill was at that time put down as worth £99,263, and the patents at £73,450. The committee have taken patents and goodwill together at £20,000. They have endeavoured to value the assets and ascertain the liabilities, and have come to the conclusion that the company is just solvent; that is to say, that under an intelligent realisation there would be just enough to pay off the liabilities, including the debentures and debenture stock. With regard to any proposal for carrying on the company, the main difficulty consists in the heavy debenture interest (£9,350), to which must now be added £2,000 interest on the secured debenture stock, authorised at the last general meeting. This is an intolerable weight for the company, with its diminished resources, to bear. Your committee visited the Cornbrook and Kidsgrove works, and were favourably impressed by the managers there. Neither were sanguine. The former thought that if £500 were spent in new plant, he might be able to make £1,000 or £2,000 a year; the latter thought that with £7,000 additional capital he might be able to make a profit of about £2,500 a year. Mr. Stuchbury, at Cannon Street, thought that the merchants' business might possibly produce £4,000 a year. In what is called the financial business, the only chance seems to lie in the Epstein business, which Mr. Epstein estimates might produce £5,000 a year, one-half of which will come to this company, and there is also a rent of £500 paid by this company. All the profit thus visible to your committee is £11,000 a year. Unless the vendor can be made, or is willing, to revert to the original arrangement, this profit would be only just sufficient to meet the debenture interest, and there would be no inducement for the shareholders to subscribe fresh capital. It seems clear that it is no use attempting to raise capital which would be subject to the existing debentures. A more hopeful proposal would be that a new and perfectly independent company, under fresh management, should be formed, which should lease from the old company their existing plants and works; that this company should carry on the existing manufacturing and merchant business, which is of considerable volume, buying from and selling at a commission for the old company, the existing stock;

and, as the assets are realised, the debentures might be paid off. A company with a small and reasonable capital, unburdened by a heavy debenture interest, might be able under these circumstances, to make a living profit. It is only within the last few days that your committee have been able to ascertain the position of the company, and they are not prepared to propose any more definite scheme for the future." After a grateful reference to the able assistance Mr. Pixley and Mr. Pilling (the auditor and accountant respectively) had rendered to the committee, the chairman concluded by pointing out that no one but a madman would put fresh capital into the company which would be subject to the debentures; therefore any reconstruction which entailed fresh money being put in must secure that fresh money from attack by the debenture holders. In his opinion any scheme of reconstruction would call for a good deal of consideration.

GENERAL FIFE, one of the committee of investigation, said he agreed with most of the statements in the report, but he had refused to sign it because he thought it was compiled too hastily, and several of the statements required further modification.

Mr. E. J. SWAIN thanked the chairman and the committee for the excellent work they had done; the report made it evident that the whole business was as rotten as it very well could be, and he did not get a gleam of comfort from the sources which made the chairman sanguine. Since the last meeting he had made careful private inquiries, which disclosed that the plant of the company was as antiquated as it could be, and that none of its patents were of greater value than other patents in the market. Under these circumstances he thought the sooner the whole affair was wound up the better. He came to the conclusion from the prospectus that the new issue of shares was a *bonâ fide* affair, but he had since found out that the capital under the new issue was wanted to pay off old scores, and what was worse, that the directors had it, and had had the audacity to threaten proceedings for the amount of money not paid up on the last issue.

Mr. F. L. RAWSON, the managing director, said that it was, of course, very important that the committee should place the result of their investigations before the shareholders at the earliest possible moment, and probably that was why the report had not been first submitted to the directors, in order that their explanations might be given upon some of the points that had been raised. So far from opposing the committee's investigating the past, he had urged that the whole matter should be gone into. In reference to the profit from the Okonite Company, the directors took counsel's opinion upon it, and the same remark applied to the Kensington Stores. They might have been wrong in treating the premium on shares as profit, but the shareholders had notice of it. Personally, he had nothing to do with the purchase of the machinery at Kidsgrove or Cadby Hall. At Cadby those purchases were made by Mr. S. L. Baker, who had as good a knowledge of the value of machinery of this class as anyone. If the shareholders looked at the contract for the purchase of the Kidsgrove works, he thought they would say it was a thoroughly well drawn and satisfactory contract. He was responsible for it, and accepted that responsibility. Unquestionably they had made the mistake of putting down the assets they had in the shape of shares at too high a price. What they did was this: where there was a Stock Exchange quotation, they valued at the price of the day; where there were debentures which the directors were satisfied were good, they put them in at par. As a rule, there was no market price for the debentures they dealt in. The company was not a company to buy shares, but they had taken payment in shares. With regard to the Epstein Company's shares, he was perfectly certain that they had not been overvalued. They took the founders' shares at nothing, though he considered they would prove more valuable than the ordinary. As to the Paris concession, it had not been a dead loss. They spent about £10,000, and received back about £4,500 in cash, and had shares in a Paris electric lighting company representing £5,000 odd, and also some founders' shares as a sort of bonus. One of the Parisian banks took £40,000 or £50,000 of shares at par in that company; so they might look on them as worth par. A concession was obtained, but the company was not brought out, because they were not satisfied that the people working it in France would have worked well for an English company. With regard to the Maskelyne Typewriter Company, they had made a loss of £1,000 by settling the claim that company had upon them for £7,500, but under the circumstances, he was sure the arrangement was advantageous. The industrial part of the business certainly had not been properly organised, and for that he blamed himself; but he had been attending to the various undertakings in which they were interested, and he had had to devote a large amount of time to pulling them through. The management of the Kidsgrove and Manchester businesses was now, however, highly satisfactory. The Elmore shares received from Woodhouse & Rawson, Limited, were sold not for shares but for cash, and a profit was made out of the transaction. He had never received a penny of cash for any shares sold to the company. He had done what he could for the benefit of the shareholders, sacrificing his own money and sacrificing and running risks with the funds of his friends, who invested on his recommendation in businesses in which the company was interested.

A SHAREHOLDER asked how Mr. Rawson came to ask for the guarantee fund to be paid back.

Mr. RAWSON said he did not do so; on the contrary, he fought tooth and nail to get the best possible terms for the shareholders. With reference to the cross transactions at the various times referred to, Mr. Rawson explained that the company often wanted money, and he obtained it from his friends and lent it to the company, who afterwards paid it back.

Mr. SAMUEL POPE, Q.C., a director, thought that whatever happened he must be a considerable loser of hard cash, although he had not been engaged in the company's affairs throughout the whole of the year. Besides being a director he was a trustee for the 5½ per cent. debenture stock holders, and had to take care the assets were not squandered to their detriment. He believed that most of the facts stated in the report were true, but he did not agree with all the committee's deductions from them. For instance, as regarded the transaction by which the £75,000 guarantee was relinquished, he honestly believed that, under the whole of the circumstances, although in the light of subsequent events shareholders had been deprived of the certain protection for their dividend at the moment, the transaction was very much for the benefit of the company. They must not fall into the error of judging by subsequent events. When dealing with the matter the directors did not know that there would be two years of financial depression to go through, when it would be impossible with any prospect of success to deal with any electrical invention. As to profits, it was not usual for companies to wait until their assets became liquid before declaring them as profits or dividend. In his judgment, Okonite debentures at the present moment were an absolute security at par; the company had admirable prospects before it, and was earning considerable amounts in America. He disagreed with the paragraph in the report stating that the company was founded as an industrial company only, and recalled the fact that after the first year's working he had told the shareholders that they could not expect that profits such as were then declared could be made out of an industrial business, and one of the shareholders said he did not care where they came from so long as they got them. (Laughter.) He would suggest that they waited until they could call a general meeting, to which might be submitted some scheme of reconstruction which might commend itself to the general body of the shareholders and debenture holders.

The CHAIRMAN agreed that the course suggested by Mr. Pope was the proper one, pointing out that the meeting was not a formal meeting of the company called by the directors, but one summoned by himself, consequently they had no power to pass resolutions binding the company.

Mr. ABRAHAM thought the one bright spot in the history of this company was the way Mr. Pope had behaved from the beginning to the end. According to the report, Mr. Rawson was not in a very comfortable position; but Mr. Rawson had explained his position from his own point of view, and what they (the shareholders) wanted to get from the directors was whether they endorsed the views of Mr. Rawson, and how Mr. Rawson was led to take the part he had done and act in the way he had throughout. From first to last he had never been able to understand how this company launched into the business of a patent agency; that could not have been in the contemplation of any shareholder of the company.

Mr. GRIFFITHS, a member of the committee, said that if they wished to produce large profits more capital was imperative. In his opinion it was premature to wind up the company, because if any concern were wound up the goodwill of it as a going concern was destroyed. The question was whether they had not some legal ground on which they might reclaim the guarantee fund from those who had received it. As at present advised, he did not say that they could recover it, but it did appear to him that the persons who had parted with it ought to have been thoroughly acquainted with the facts, and ought not to have given it up when the consequence was that the company got for one year a profit of £12,000, but crippled itself altogether for the future by paying some thousands of pounds every year by way of interest.

Mr. BOND wanted to know what the position of the committee was. He considered that the best course would be for them to join the directors in devising the best scheme for meeting the deplorable position in which they found themselves.

The CHAIRMAN said the committee considered their functions at an end when they had investigated and reported on the condition of the company. Privately, no doubt, the members of the committee would express an opinion on any scheme of reconstruction put forward by the directors.

Mr. BACON moved that the report be printed and circulated amongst the shareholders.

Mr. H. R. PEAKE seconded.

The resolution was agreed to.

Mr. RAWSON said that the directors had been taking the advice of some practical business men upon the question of reconstruction, and a suggestion had been made by a large debenture holder upon which they were inclined to look favourably. If adopted, this would protect the interest of the debenture and debenture stock holders, and also save some of the shareholders money. The directors saw no reason why that scheme should not be laid before the shareholders before the end of the month.

Mr. MADDISON, on behalf of debenture and debenture stock holders, urged the desirability of giving to the shareholders every opportunity of saving the assets of the company as a going concern. He deprecated any undue haste in realisation of their property.

A discussion followed as to the calling of a special general meeting, the result of which was that it was understood that the directors would call such a meeting, to follow the adjourned annual meeting, and consider any scheme of reconstruction that might be submitted.

Thanks were voted to the chairman, and the proceedings terminated.

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## The House-to-House Electric Light Supply Company, Limited.

THE fourth annual report of the directors for the year ended December 31st, 1892, reads as follows:—

"The directors beg to submit to the shareholders the balance-sheet and accounts for the year ended December 31st, 1892. The revenue account shows a credit balance of £2,836 19s., which, with the sum of £525 referred to below, and the balance of £291 0s. 8d.

brought forward from the previous year, makes a total of £3,652 19s. 8d. The directors propose to deal with this amount as follows:

| | £ | s. | d. |
|---|---|---|---|
| Interest paid on £30,000 debentures ... ... | 1,800 | 0 | 0 |
| In reduction of preliminary expenses ... | 500 | 0 | 0 |
| In reduction of suspense renewals account ... | 100 | 0 | 0 |
| Depreciation fund ... ... ... ... | 250 | 0 | 0 |
| Dividend of 7 per cent. on amounts paid up on £21,155 preference shares ... ... | 962 | 5 | 5 |
| Leaving a balance to be carried forward of ... | 40 | 14 | 3 |
| | £3,652 | 19 | 8 |

"The directors have the pleasure to report that during the past year the business of the company has continued to increase; the number of lamps attached to the company's circuits on January 1st being the equivalent of 19,388 8-C.P. lamps, and on December 31st 23,700. At the beginning of the year there were 373 houses connected, and at the end of the year 471. During the year another unit of plant has been laid down. This addition admits of the number of connected lamps being increased to 28,000 8-C.P. A further issue of 7 per cent. preference shares was made during the autumn, bringing the total preference capital issued up to £21,155. In addition to the profits at Kensington, the sum of £525 is guaranteed to the company for the year 1892 in connection with the business of central station construction which the Leeds and London Electrical Engineering Company, Limited, took over from the company, a similar amount being guaranteed for the current year. The directors have drawn no fees during the year, but £200 has been paid to Mr. William Page for special services. Mr. R. A. Germaine and Mr. William Page retire from the board by rotation, and, being eligible, offer themselves for re-election Messrs. Theobald Bros. and Miall, the auditors of the company, retire, and submit themselves for re-election."

ABSTRACT OF ACCOUNTS to December 31st, 1892.

CAPITAL ACCOUNT.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Expenditure per last account ... ... ... | 58,376 | 1 | 6 |
| „ Further expenditure to December 31st, 1892 ... | 11,391 | 12 | 3 |
| „ Balance ... ... ... ... ... ... | 7,027 | 6 | 3 |
| | £76,795 | 0 | 0 |

| Cr. | £ | s. | d. |
|---|---|---|---|
| By Ordinary shares ... ... ... ... ... | 26,610 | 0 | 0 |
| „ Preference shares ... ... ... ... ... | 19,685 | 0 | 0 |
| „ Founders' shares ... ... ... ... ... | 500 | 0 | 0 |
| „ Debentures ... ... ... ... ... ... | 30,000 | 0 | 0 |
| | £76,795 | 0 | 0 |

REVENUE ACCOUNT.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Generation of electricity ... ... ... ... | 6,336 | 2 | 11 |
| „ Distribution of electricity ... ... ... | 104 | 17 | 7 |
| „ Proportion of rents, rates and taxes ... ... | 427 | 18 | 4 |
| „ „ of management expenses ... ... | 752 | 5 | 2 |
| „ „ of law and Parliamentary charges ... | 87 | 18 | 9 |
| „ Special charges and sundries ... .. ... ... | 142 | 16 | 9 |
| „ Balance ... ... ... ... ... ... ... | 2,836 | 19 | 0 |
| | £10,688 | 18 | 6 |

| Cr. | £ | s. | d. |
|---|---|---|---|
| By Sale of current per meter ... ... ... ... | 9,705 | 5 | 0 |
| „ Rental of meters, converters, &c. ... ... ... | 708 | 5 | 11 |
| „ Other items ... ... ... ... ... ... | 275 | 7 | 7 |
| | £10,688 | 18 | 6 |

NET REVENUE ACCOUNT.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Interest on debentures ... ... ... ... ... | 1,800 | 0 | 0 |
| „ Amount written off preliminary expenses ... ... | 500 | 0 | 0 |
| „ „ „ suspense renewals ... ... | 100 | 0 | 0 |
| „ Depreciation fund ... ... ... ... ... | 250 | 0 | 0 |
| „ Balance ... ... ... ... ... ... ... | 1,002 | 19 | 8 |
| | £3,652 | 19 | 8 |

| Cr. | £ | s. | d |
|---|---|---|---|
| By Balance from account, less dividend on preference shares to December 31st, 1891 ... ... ... | 291 | 0 | 8 |
| „ Profit guaranteed by the Leeds and London Electrical Engineering Company ... ... ... ... | 525 | 0 | 0 |
| „ Balance from revenue account... ... ... ... | 2,836 | 19 | 0 |
| | £3,652 | 19 | 8 |

GENERAL BALANCE-SHEET.

| Dr. | £ | s. | d. |
|---|---|---|---|
| To Capital account ... ... ... ... ... | 61,795 | 0 | 0 |
| „ 300 debentures of £100 each ... ... ... | 30,000 | 0 | 0 |
| „ Sundry tradesmen and others, on construction of plant, machinery, fuel, &c. ... ... ... | 3,873 | 0 | 9 |
| „ Sundry creditors on open accounts... ... ... | 4,548 | 17 | 0 |
| „ Depreciation fund account ... ... ... ... | 250 | 0 | 0 |
| „ Net revenue account, balance at credit thereof ... | 1,002 | 19 | 8 |
| | £101,469 | 17 | 5 |

| Cr. | £ | s. | d. |
|---|---|---|---|
| By Capital account ... ... ... ... ... | 69,767 | 13 | 9 |
| „ Preliminary expenses and foundation of business account ... ... ... ... ... ... | 4,744 | 18 | 2 |
| „ Construction business development account ... | 16,985 | 14 | 1 |
| „ Cash at bankers „ in hand ... ... ... ... ... | 2,691 | 16 | 6 |
| „ Sundry debtors for current ... ... ... ... | 4,433 | 1 | 9 |
| „ Other „ ... ... ... ... ... | 2,138 | 3 | 9 |
| „ Stores on hand ... ... ... ... ... | 408 | 9 | 5 |
| „ Suspense renewals account ... ... ... ... | 300 | 0 | 0 |
| | £101,469 | 17 | 5 |

The fifth ordinary general meeting of this company was held at the company's central station, Richmond Road, Earl's Court, S.W., on Thursday last, under the presidency of Mr. Henry Ramié Beeton.

The SECRETARY (Mr. H. St. John Winkworth) read the notice convening the meeting, and the report of the directors and statement of accounts were taken as read.

The CHAIRMAN: Gentlemen,—The whole of the capital expended has been laid out with the strictest economy, and at the hands of the company's own staff, without having occasion to have recourse to the more or less costly services of professional engineers. The expenditure in question, amounting to £11,391 12s. 3d., represents the construction of a large portion of our second smoke stack, which will suffice for our completed station, comprising three times the power we possess at present, and, in addition, it represents plant equal to the supply of 28,000 35-watt lamps, after providing the requisite reserve and mains equal to the accommodation, under favourable circumstances, of 40,000 35-watt lamps. With regard to the revenue operations exhibited in the accounts, I have to point out that, for the first time in the history of the company, they represent continuous day-and-night running, and having entered upon this stage of our duties to the public, such figures, while they will furnish a basis for comparison for future years, furnish, of course, no basis of comparison with past years. In these circumstances it is, I venture to think, matter for congratulation that with the heavy extra consumption of coal and labour which we have had to face, our cost of working should amount to the same as for 1891. For this reason and for others revealed by a more detailed analysis of the accounts, I think I can promise you that with the careful and conscientious assistance of Mr. Page (to whose assiduity and foresight I and my colleagues, and by consequence you yourselves, are so much indebted), by persevering along the lines we are now following, and by a limited capital expenditure on the sub-stations for securing more economical distribution, we shall be able to present you with more satisfactory results in the future. If this assurance is warranted, as I fully believe it to be, I am sure that you will agree with me that our debenture and preference capital is fully secured, and that our preference shares constitute as good an investment as the market for this class of property affords; but it is, I can assure you, matter of regret to me that the hopes of the ordinary shareholders remain still to be fulfilled. The fact is, that in this as in other enterprises of a similar nature, we have drawbacks to contend with, even although they carry with them compensations; but unfortunately our drawbacks are in the present and our compensations are in the future. The situation of our station is such that it can never create a nuisance to the neighbourhood, and it secures us accordingly from all possibility of difficulty and disturbance with the growth of our business in the future, but it imposes upon us a system of distribution in the earlier stages of the business, although the smaller capital involved is an advantage which is secured now and hereafter. Moreover, laying mains as we have done in all the thoroughfares scheduled to the area which is proper to our station, has resulted in our having at present a sparse distribution of lights, as the comparative statistics of other companies show, and in short, the class of custom depending upon the character of our area while very sure is somewhat slow, so that there remains nothing for us but to run in patience the race which is set before us. With these few remarks I beg to move that the report and accounts be adopted.

The MANAGING DIRECTOR (Mr. Robert Hammond) in seconding, explained that, acting under the advice of their engineers, they had made certain alterations in the arrangement of their steam pipes. Under their old system of having one main connecting the whole of their engines and boilers, it was found in practice to be very wasteful of steam. They consequently erected smaller steam pipes, by which any particular engine or boiler could readily be disconnected when not working. These improvements were carried out the latter part of last year, and the accounts showed a great saving of coal, &c. The other point he would like to mention was the laying down of sub-stations, as under the old plan of putting in a converter for reducing the electricity from high to low tension, a great loss of current was apparent. To avoid this the directors had decided to adopt the system of grouping the converters in convenient places by which any

portion of the mains could readily be got at and switched off when not in actual use. This, when completed, should show a marked improvement in their revenue. In drawing their attention to the amount of £525, which was again guaranteed by the Leeds and London Electrical Engineering Company, he observed that under their agreement, certain contingencies were provided for by which they might derive still greater benefits from that company in the future.

Mr. ARTHUR KIMBER asked as to the number of lights that had been connected since January 1st this year.

Mr. J. J. FROST wished to know if the directors could not see their way to pay an interim dividend as most companies were accustomed to do, and which would be very convenient to the shareholders.

The CHAIRMAN replied that the number of lights connected since January 1st this year, was about 1,500, and that the subject of paying half-yearly dividends upon the preference shares would receive the careful consideration of the directors.

The motion was carried unanimously.

The CHAIRMAN proposed "That a dividend of 7 per cent. per annum be declared upon the amounts paid up on the preference shares."

Mr. W. F. LEESE seconded and the motion was carrid *nem con.*

The CHAIRMAN proposed, and Mr. W. F. LEESE seconded, "That Mr. Wm. Page be re-elected a director of the company."

The motion was carried unanimously.

The CHAIRMAN proposed, and Mr. ROBERT HAMMOND seconded, "That Mr. R. A. Germaine be re-elected a director of the company."

The motion was carried unanimously.

Mr. KIMBER proposed, and Mr. J. J. FROST seconded, "That Messrs. Theobald Bros. and Miall be re-elected auditors for the ensuing year."

The motion was agreed to.

Mr. KIMBER proposed, and Mr. S. F. BEEVOR seconded, a vote of thanks to the chairman and directors, which was carried unanimously, and the proceedings terminated.

## South Staffordshire Tramways Company.

THE fourth annual meeting of the shareholders of the South Staffordshire Tramways Company was held at the company's depôt, Darlaston, on the 1st inst., Mr. W. J. Carruthers-Wain presiding.

The SECRETARY read the following circular, which had been addressed by the chairman to the shareholders:—

"Darlaston, February 27th, 1893.—Dear Sir,—Possibly I may save you a fruitless journey to Darlaston on Wednesday next, the 1st prox., by informing you that I intend to move the adjournment of the meeting on the following grounds:—1st. A libellous circular, full of misleading statements, has been secretly and at the last moment issued to certain selected shareholders, but not to the directors or officers of the company. 2nd. Many of the shareholders whose names appear in the circular have written me disavowing all responsibility for its statement. 3rd. The board will issue a full and categorical reply to the circular. 4th. I propose to commence an action for libel against such members of the self-constituted committee as do not repudiate the circular, so that an opportunity may be given to investigate the facts before a judicial tribunal and not before a committee instigated by interested and designing agencies. 5th. As an illustration of the gross misrepresentations of fact, it may be mentioned that instead of the self-appointed committee holding £10,000 in the company, as they allege, their holding is actually £3,740.—I am, yours faithfully, W. J. CARRUTHERS WAIN, Chairman."

The CHAIRMAN said he held in his hand a number of letters from "so-called supporters of the so-called Shareholders' Protection Committee," disavowing in the most express terms all knowledge of the circular issued by that body, and the statements contained therein, and in many cases stating that they had written to one of the members of the committee requesting that those who had so misused their names might be called upon to correct and withdraw their statements. He further held a letter from one of the so-called committee absolutely disavowing the issue of the circular and all responsibility for the terms in which it had been drawn up, and desiring him to accept that disavowal as an apology. He was not going to detain the meeting now by entering into any of those matters which had been raised by the self-constituted committee. That he would do at the proper time. The reply of the directors would be issued, and he would then take such proceedings as he might be advised to vindicate his personal character. He proposed the adjournment of the meeting to that day three months, at the same time and place.

After much discussion, in the course of which several of those present desired to be heard on an amendment, the motion was put to the meeting.

The CHAIRMAN then put the motion. About thirty hands were held up in its favour and seven against, and the chairman declared it carried by an overwhelming majority.

The proceedings then terminated.

**W. T. Henley's Telegraph Works.**—The report for the year 1892 states that the accounts show a net profit of £15,456, after charging interest on the mortgage and debentures and writing off £3,500 for depreciation of machinery and ship gear. Adding £21,731 brought forward from last year, and deducting £808, the half-year's dividend to June 30th, 1892, paid in October, on the preference shares, there remains a disposable balance of £36,378. The directors have added £18,545 to the reserve fund, and they propose the payment of a further half-year's dividend on the preference shares at the rate of 7 per cent. per annum, and a dividend for the year at the rate of 5 per cent., free of income tax, on the ordinary shares, leaving a balance of £13,425 to be carried forward. Of the £30,000 "B" debentures created in 1891, £14,000 was paid off during the past year, and the directors purpose to pay off immediately a further £4,000, which will reduce the amount of these debentures to £12,000. The general business of the company in the manufacture of electric light cables, telephone cables, &c., has been satisfactory, and a considerable quantity of submarine telegraph and mining cables has been constructed for the British and foreign Governments. A branch establishment has been opened during the current year at Melbourne, Australia.

**The Consolidated Telephone Construction and Maintenance Company, Limited.**—An extraordinary general meeting of the members of the Consolidated Telephone Construction and Maintenance Company, Limited, was held at Winchester House, Old Broad Street, E.C., on Thursday, the 9th inst., when the following was passed as a special resolution:—"That the capital of the company be reduced from £307,545, divided into 75,000 preference shares of £1 each, 75,150 ordinary shares of £1 each, and 224,850 ordinary shares of 14s. each, to £234,988, divided into 47,363 preference shares of £1 each, and 75,150 ordinary shares of £1 each, and 224,850 ordinary shares of 10s. each; and that such reduction be effected by returning the amount of £1 per share credited as paid upon each of the 27,637 issued preference shares of the company to the holders thereof, and thereupon cancelling such shares, and by returning 2s. per share to each of the holders of the 224,850 issued ordinary shares of the company, and by writing off each of the said 224,850 ordinary shares the sum of 2s. per share as being capital unrepresented by available assets." This resolution will be submitted for confirmation as a special resolution to a second extraordinary general meeting, which will be subsequently convened.

**Commercial Cable Company.**—The directors have issued their report for the year 1892, in anticipation of the meeting to be held on the 20th inst., in which it is stated that the gross earnings for that period amounted to $1,890,377, and the net revenue to $1,099,587, the latter showing an increase of $14,263 as compared with those of 1891. Quarterly dividends of 1¾ per cent. each have been paid, absorbing $540,120, while debenture bonds to the amount of £600,000 were redeemed on January 15th last, reducing the total amount outstanding to £80,000. In order to make provision for the laying down of a third cable, it has been decided to offer to the shareholders, for subscription at par, 19,290 shares, out of 22,840 shares now unissued. Each shareholder will thus be entitled to subscribe for one share for every four shares held.

**The Phosphor-Bronze Company, Limited.**—At the annual general meeting held at the Bridge House Hotel, London, S.E., on Friday, February 24th, 1893, Mr. James Rock, presiding, the report of the directors and the accounts were adopted, and dividends of 5 per cent. on the preference shares, and 1¼ per cent. on the ordinary shares were declared, the same to be paid on or before March 31st next. £1,000 was added to the contingency fund, and £134 1s. 2d. was carried to new account. Mr. Richard Gamble, was re-elected a director. Mr. Robert Payne, F.C.A., was re-elected auditor. A vote of thanks to the chairman closed the proceedings.

**The Direct Spanish Telegraph Company, Limited.**—The board have decided to recommend the payment of the dividend at the rate of 10 per cent. per annum on the preference shares, and a dividend at the rate of 4 per cent. per annum, free of income tax, upon the ordinary shares, both for the half-year ended December 31st last.

**Stock Exchange Announcements.**—The Stock Exchange Committee have appointed a special settling day—Tuesday, March 14th—in the City and South London Railway Company Perpetual 5 per cent. Preference Shares, Nos. 1 to 7,000, and have ordered these preference shares, as well as £30,000 additional ordinary stock, to be quoted in the official list.

**Brazilian Submarine Telegraph Company, Limited.**—The directors of this company have declared an interim dividend of 3s. per share, or at the rate of 6 per cent. per annum, free of income tax, for the quarter ended December 31st, 1892, and payable on the 25th inst. The books of the company will be closed from the 18th to 24th inst., both days inclusive.

**Kobe Electric Light Company.**—The Kobe Electric Light Company held its half-yearly general meeting on the 8th inst., and decided to pay a dividend of 12 per cent. (or 3 yen per share), and to divide the present shares of 50 yen each into two, *i.e.*, of 25 yen each, besides increasing the amount of capital.

**Andrews and Preece, Limited.**—At the annual meeting of shareholders of Andrews and Preece, Limited, held last Tuesday at the company's offices, a dividend of 5 per cent. was declared for the year ending December 31st, 1892.

## TRAFFIC RECEIPTS.

The City and South London Railway Company. The receipts for the week ending March 5th, 1893, amounted to £929; week ending March 6th, 1892, £893; increase £36; total receipts for half-year, 1893, £8,672 corresponding period, 1892, £7,632; increase £1,040.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of February, 1893, amounted to £1,808, against £1,865 in the corresponding period of last year.

The Great Northern Telegraph Company. The traffic receipts in February, 1893, amounted to £20,400; January 1st to February 28th, £41,200; corresponding month, 1892, £40,800; corresponding months, 1891, £41,600.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending March 3rd, after deducting 17 per cent. of the gross receipts payable to the London Platino-Brazilian Telegraph Company Limited, were £3,816.

## SHARE LIST OF ELECTRICAL COMPANIES.

| Present Issue. | Name. | Stock or Share.† | Closing Quotation March 2nd. | Closing Quotation, March 9th. | Business done during week ended March 9th, 1893. Highest. | Lowest. |
|---|---|---|---|---|---|---|
| 195,100*l* | African Direct Telegraph, Ltd., 4 p. c., Deb. Regd. and to Bearer | 100 | 100 —103 | 100 — 103 | ... | ... |
| 1,247,720*l* | Anglo-American Telegraph, Limited ... ... ... ... ... ... | Stock | 53½— 54½ | 52 — 53 | 52⅝ | 52 |
| 2,876,140*l* | Do. do. 6 p. c. Preferred ... ... ... ... ... ... | Stock | 94½— 95½ | 91½— 92½ | 94⅝ | 91½ |
| 2,876,140*l* | Do. do. Deferred ... ... ... ... ... ... | Stock | 13¼— 13⅝ | 13¼— 13⅜ | 13½ | 12½ |
| 130,000 | Brazilian Submarine Telegraph, Limited ... ... ... ... | 10 | 12 — 12½ | 12 — 12⅛ | 12¼ | ... |
| 34,600*l* | Do. do. 5 p. c. Bonds ... ... ... ... ... | 100 | 100 —103 | 100 —103 | ... | ... |
| 75,000*l* | Do. do. 5 p. c., 2nd Series, repayable in June, 1906 ... | 100 | 105 —109 | 105 —109 | ... | ... |
| 77,978 | Brush Electrical Engineering Ordinary, Nos. 1 to 63,416 ... ... | 3 | 3⅛— 3⅜xd | 3⅛— 3⅜xd | 3 5/16 | 3⅛ |
| 75,000 | Do. do. Non cum. 6 p. c. Preference, Nos. 1 to 63,416 | 2 | 2⅛— 2⅜xd | 2⅛— 2⅜xd | 2 5/16 | 2⅛ |
| 125,000*l* | Do. do. 4½ per cent. Debenture Stock ... ... | Stock | 103 —105 xd | 103 —105 xd | 104½ | 104 |
| 40,000 | Chili Telephone, Limited, Nos. 1 to 40,000 ... ... ... ... | 5 | 3 — 4 | 3 — 4 | ... | ... |
| 600,000*l* | City and South London Railway ... ... ... ... | Stock | 35 — 37 | 35 — 37 | 37 | ... |
| 40,000 | City of London Elec. Lighting Co., Ltd., Ord. 40,001-80,000 ... | 10 | 12½— 13 | 12½— 13 | 12 15/16 | 12⅝ |
| 20,000 | Do. do. 6 p. c. Cum. Pref., Nos. 1 to 20,000 | 10 | 8¾— 8⅞ | 8¾— 8⅞ | 8 9/16 | ... |
| $7,716,000 | Commercial Cable, Capital Stock ... ... ... ... ... | $100 | 175 —180 | 175 — 180 | ... | ... |
| 224,850 | Consolidated Telephone Construction and Maintenance, Limited .. | 14/- | 9/16— 5/8 | ¼— ⅜ | ... | ... |
| 20,000 | Crompton & Co., Ltd, 7 p. c. Cum. Pref. Shares, Nos. 1 to 20,000 | 5 | 5 — 5½ | 5 — 5½ | 5 7/16 | ... |
| 16,000 | Cuba Telegraph, Limited ... ... ... ... ... ... | 10 | 11½— 12½xd | 11½— 12½xd | ... | ... |
| 6,000 | Do. do. 10 p. c. Preference ... ... ... ... | 10 | 17½— 18½xd | 17½— 18½xd | ... | ... |
| 12,931 | Direct Spanish Telegraph, Limited, ... ... (£4 only paid) | 5 | 2½— 3½ | 2½— 3½ | ... | ... |
| 6,000 | Do. do. 10 p. c. Preference ... ... ... | 5 | 9 — 10 | 9 — 10 | ... | ... |
| 60,710 | Direct United States Cable, Limited, 1877 ... ... ... .. | 20 | 11⅝— 12 | 11⅝— 11⅞ | 11⅞ | 11 11/16 |
| 400,000 | Eastern Telegraph, Limited, Nos. 1 to 400,000 ... ... ... | 10 | 14⅝— 15½ | 14⅞— 15½ | 15 1/16 | 14⅝ |
| 70,000 | Do. 6 p. c. Preference ... ... ... ... ... | 10 | 15⅝— 16½ | 15½— 16 | 15⅝ | ... |
| 200,000*l* | Do. 5 p. c. Debs. (1879 issue), repay. August, 1899 | 100 | 107 —110 | 107 —110 | ... | ... |
| 1,200,000*l* | Do. 4 p. c. Mortgage Debenture Stock ... ... | Stock | 113 —116 | 113 —116 | 114½ | 113 |
| 250,000 | Eastern Extension, Australasia and China Telegraph, Limited ... | 10 | 15¼— 15½ | 15⅝— 15⅝ | 15½ | 15¼ |
| 70,600*l* | { Do. 5 p. c. (Aus. Gov. Sub.), Deb., 1900, red. ann. drgs. reg. 1 to 1,049, 3,976 to 4,326 } | 100 | 103 —106 | 103 —106 | ... | ... |
| 250,200*l* | Do. do. Bearer Nos. 1050—3,975 and 4,327—6,400 ... | 100 | 103 —106 | 103 —106 | 103¾ | ... |
| 320,000*l* | Do. 4 p. c. Debenture Stock ... ... ... ... ... | Stock | 110 —113 | 110 —113 | ... | ... |
| 122,400*l* | { Eastern and South African Telegraph, Ltd., 5 p. c. Mort. Deb. 1900 redeem. ann. drawings, Registered Nos. 1 to 2,343 } | 100 | 102 —105 | 102 —105 | 103½ | ... |
| 163,700*l* | Do. do. do. to bearer, Nos. 2,344 to 5,500 | ... | 102 —105 | 102 —105 | 102⅝ | ... |
| 300,000*l* | Do. do. 4 p. c. Mort. Debs. Nos. 1 to 2016, red. 1909 | 100 | 101 —104 | 101 —104 | 102½ | ... |
| 45,000 | Electric Construction, Limited, Nos. 101 to 45,100 ... ... ... | 10 | 3⅜— 4¼ | 3½— 4 | 3⅝ | ... |
| 19,900 | *Electricity Supply Co. of Spain, Nos. 101 to 20,000 ... ... ... | 5 | ... ... | ... ... | ... | ... |
| 100,000 | Elmore's French Patent Copper Depositing Co., Ltd, Nos. 1 to 66,750 | 2 | ¼— ½ | ¼— ½ | ... | ... |
| 82,395 | Elmore's Patent Copper Depositing, Limited., Nos. 1 to 70,000 ... | 2 | ⅜— ⅝ | ⅜— ⅝ | ... | ... |
| 67,385 | Elmore's Wire Mfg., Ltd., Nos. 1 to 67,385, issued at 1 p.m., all pd. | 2 | ¼— ½ | ¼— ½ | ... | ... |
| 20,000 | Fowler-Waring Cables, Nos. 301 to 20,300 ... (£4 10s. only paid) | 5 | 1½— 2½ | 1½— 2½ | ... | ... |
| 180,227 | Globe Telegraph and Trust, Limited ... ... ... ... ... | 10 | 9⅜— 9⅞ | 9⅜— 9⅞ | 9⅞ | 9 11/16 |
| 180,042 | Do. do. 6 p. c. Preference ... ... ... | 10 | 15½— 15⅞ | 15½— 15⅞ | 15⅞ | 15½ |
| 150,000 | Great Northern Tel. Company of Copenhagen ... ... ... | 10 | 19 —19½ | 19 — 19½ | 19 7/16 | 19½ |
| 210,000*l* | Do. do. 5 p. c. Debs. (issue of 1883) ... | 100 | 104 —107 xd | 104 —107xd | ... | ... |
| 12,134*l* | Greenwood and Batley, Ltd., Ordinary, Nos. 4667 to 14,000 ... | 10 | 4½— 5½ | 4½— 5½ | ... | ... |
| 9,600*l* | Do. 7 p. c. Cumulative Preference, Nos. 2,667 to 8,000 | 10 | 6½— 7½ | 6½— 7½ | ... | ... |
| 50,000 | India-Rubber, Gutta Percha and Telegraph Works, Limited .. | 10 | 22 — 23 xd | 22 — 23 xd | 23 | 22½ |
| 200,000*l* | Do. do. 4½ p. c., Deb., 1896 ... ... ... | 100 | 104 —106 | 104 —106 | ... | ... |
| 17,000 | Indo-European Telegraph, Limited ... ... ... ... ... | 25 | 43 — 45 | 44 — 46 | ... | ... |
| 11,334 | International Okonite, Ltd., Ordinary Nos. 22,667 to 34,000 ... | 10 | 2½— 3½ | 2½— 3½ | ... | ... |
| 11,334 | Do. do. Preference Nos. 5,667 to 17,000 ... | 10 | 6 — 7 | 6 — 7 | ... | ... |
| 30,000 | †Liverpool Electric Supply, £3 10s. paid ... ... ... ... | 5 | 4½— 4¾ | 4½— 4¾ | 4¾ | 4 15/16 |
| 10,000 | Do. do. fully paid ... ... ... ... | 5 | 5⅝— 6 | 5⅝— 6 | 5⅞ | ... |
| 38,348 | London Platino-Brazilian Telegraph, Limited ... ... .. | 10 | 4 — 6 | 4 — 6 | ... | ... |
| 100,000*l* | Do. do. do. 6 p. c. Debentures ... ... | 100 | 105 —108 xd | 105 —108 xd | ... | ... |
| 49,900 | *Metropolitan Electric Supply, Ltd., Nos. 6,101 to 50,000 (£9 paid) | 10 | 5⅜— 6¼ | 5½— 5⅝ | 5 15/16 | 5 5/16 |
| 50,000*l* | Do. 5 p.c. debentures, 1 to 5,000 in bonds of £10, £20, £40 | ... | 102 —105 | 102 —105 | ... | ... |
| 454,747 | National Telephone, Limited, Nos. 1. to 438,984 ... ... ... | 5 | 5½— 5⅝ | 5½— 5⅝ | 5 5/16 | 5 1/16 |
| 15,000 | Do. 6 p. c. Cum., 1st Preference ... ... ... | 10 | 14½— 15½ | 14½— 15½ | ... | ... |
| 15,000 | Do. 6. p. c. Cum. 2nd Preference ... ... ... | 10 | 13⅜— 14½ | 13⅜— 14½ | 14⅛ | 14 |
| 90,950 | Do. 5 p. c. Non-cum. 3rd Pref., Nos. 1 to 90,950 ... | 5 | 4⅜— 4⅝ | 4⅜— 4⅝ | ... | ... |
| 726,477*l* | Do. 4½ p.c. Deb. Stock Prov. Certs. fully paid ... | ... | 113 —116 | 113 —116 | 114⅜ | 114 |
| 48,800*l* | New Telephone, Limited, Nos. 25,901 to 74,700 ... (£2 paid) | 10 | ... ... | ... ... | ... | ... |
| 6,318 | Notting Hill Electric Lighting Company, Limited, fully paid ... | 10 | 5½— 6½ | 5½— 6½ | ... | ... |
| 220,000 | Oriental Telephone, Ltd., Nos. 80,001 to 300,000 (11s. only paid) | 1 | ⅜— ½ | ½ — ½ | ... | ... |
| 11,802 | Reuter's Limited ... ... ... ... ... ... ... ... | 8 | 7½— 8½ | 7½— 8½ | ... | ... |
| 18,680 | St. James's & Pall Mall Electric Light Co., Ltd., Ord., 101—18,780 | 5 | 7⅝— 8⅛ | 8 — 8⅛ | 8⅜ | 8⅛ |
| 20,000 | Do. do. 7 per cent. pref., Nos. 20,081 to 40,080 | 5 | 8 — 8⅛ | 8 — 8⅛ | ... | ... |
| 3,381 | Submarine Cables Trust ... ... ... ... ... ... | Cert. | 119 —124 | 118 —123 | 120 | ... |
| 78,949 | Swan United Electric Light, Limited ... ... (£3½ only paid) | 5 | 3 — 3½ | 3 — 3½ | 3 3/16 | 3 |
| 37,350 | Telegraph Construction and Maintenance, Limited ... ... ... | 12 | 35 — 38 | 35 — 38 | 36½ | 35⅞ |
| 150,000*l* | Do do. do. 5 p. c. Bonds, red. 1894 | 100 | 101 —104 | 101 —104 | ... | ... |
| 58,000 | United River Plate Telephone, Limited ... ... ... ... | 5 | 2½— 3 | 2½— 3 | ... | ... |
| 146,370*l* | Do. do. 5 p. c. Debenture Stock ... | Stock | 90 —100 | 90 — 100 | ... | ... |
| 15,609 | West African Telegraph, Limited, Nos. 7,501 to 23,109 ... .. | 10 | 6½— 7½ | 6½— 7½ | ... | ... |
| 260,900*l* | Do. do. do. 5 p. c. Debentures ... .. | 100 | 100 —103 xd | 100 —103 xd | ... | ... |
| 30,000 | West Coast of America Telegraph, Limited ... ... ... ... | 10 | 2½— 3½ | 2½— 3½ | ... | ... |
| 150,000*l* | Do. do. do. 8 p. c. Debs., repayable 1902 ... | 100 | 104 —108 | 105 —109 | ... | ... |
| 64,242 | Western and Brazilian Telegraph, Limited ... ... ... ... | 15 | 7⅞— 8½ | 7⅞— 8¼ | ... | ... |
| 33,129 | Do. do. do. 5 p. c. Cum. Preferred ... ... | 7½ | 5¾— 6¼ | 5¾— 6¼ | ... | ... |
| 33,129 | Do. do. do. 5 p. c. Deferred ... ... ... | 7½ | 2 — 2½ | 2 — 2½ | 2 5/16 | ... |
| 184,100*l* | Do. do. do. 6 p. c. Debentures "A," 1910 ... | 100 | 105 —108 | 105 —108 | ... | ... |
| 230,100*l* | Do. 6 p. c. Mort. Debs., series "B" of '80, red. Feb., 1910 | 100 | 105 —108 | 105 —108 | 107½ | ... |
| 88,321 | West India and Panama Telegraph, Limited ... ... ... | 10 | 1½— 1⅝ | 1½— 1⅝ | ... | ... |
| 34,563 | Do. do. do. 6 p. c. 1st Preference ... | 10 | 10⅞— 11¼ | 10⅞— 11¼ | 11⅛ | 11 |
| 4,669 | Do. do do. 6 p. c. 2nd Preference ... | 10 | 9 — 10 | 9 — 10 | ... | ... |
| 80,000*l* | Do. do. 5 per cent debentures (1917) No. 1 to 1,000 | 100 | 107 —110 | 107 —110 | ... | ... |
| $1,336,000 | Western Union of U.S. Tel., 7 p. c. 1st Mortgage (Building) Bonds | $1,000 | 120 —125 | 120 —125 | ... | ... |
| 175,000*l* | Do. do. 6 p. c. Sterling Bonds ... ... ... | 100 | 101 —104 xd | 101 —104 xd | ... | ... |
| 59,900 | *Westminster Electric Supply Corp., Ord., Nos. 101 to 42,953 ... | 5 | 5½— 6 xd | 5½— 6 xd | 5⅞ | 5⅝ |

* Subject to Founders' Shares. † Quotations on Liverpool Stock Exchange. Bank rate of discount, 2½ per cent. (January 26th, 1893.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED:—Blackpool Electric Tramway Company, Limited, £10 (£5 paid), 7½—7¾.—Brush Company 4½ per cent. Debenture stock, issued at 1 per cent. premium, 100—102.—Electric and General Investment, shares of £5 (£1 paid), 1½—2½.—Founders' shares, 200—225.—Electric Construction Corporation, 6 per cent. Debentures, 95—98.—Electricity Supply Corporation, Ordinary of £5, 5—5¼.—Elmore Foreign and Colonial Copper, Founders shares, 6½—7½.—European Sims-Edison Torpedo Company, shares £20 (fully paid), 20—20½.—Founders' shares, 10—20.—Halifax and Bermuda Cable 4½ per cent. bonds 80—90.—House to House Company (£5 paid) 1½—2½.—Do. 7 per cent. Preference of £5, 5—5½.—Do. 6 per cent. Debentures of £100, 97—102.—Kensington and Knightsbridge Electric Lighting Company, Limited, Ordinary Shares £5 (fully paid), 5—5½, 1st Preference Cumulative 6 per cent., £5 (fully paid), 6—6½.—Liverpool Electric Supply Shares of £5 (fully paid), 5—5⅛.—Manchester, Edison and Swan Company, £9 (£1 paid), ½—¾.—Queen Anne's Mansions Lighting and Heating, Debentures, 101—103.—Woodhouse and Rawson £5 Preference (fully paid), ½—1½.

‡ Unless otherwise stated all shares are fully paid.

## ELECTRIC FURNACE FOR LABORATORIES.

EVERY electrician and metallurgist who has read the accounts of the beautiful experiments of M. Moissan on highly refractory substances and on the production of rare metals, will be pleased to know that it is as easy to have an electric furnace in the laboratory as to have a small installation of incandescent lamps. It is a long time back since St. Clair Deville used the oxygen blow-pipe for fusing platinum. In his experiments, M. Moissan first used a current of 30 ampères and 50 volts, then one of 100 ampères and 45 volts; the temperature reached 2,500° C. Then at the Conservatoire des Arts et Metiers, with a current of 400 ampères and 70 volts, the temperature of the electric furnace reached 3,000° C. At 2,500° C., lime, strontia, and magnesia crystallised. At 3,000° C., quicklime fuses and runs like water, and carbon rapidly reduces calcium oxide.

At 2,500° C. the oxides of nickel, cobalt, manganese, and chromium are reduced by carbon in from 10 to 15 minutes. It would take too long to describe all the magnificent results obtained by electric fusion; all the experiments of electro-metallurgy can be made with the electric furnace for laboratory use constructed by MM. Ducretet and L. Lejeune, which we describe, and which not only enables temperatures above 3,000° C. to be reached, but also enables the electro-thermic reactions which take place in this powerful crucible to be studied.

The crucible, C R, is made of a highly refractory substance, which can be withdrawn at will from its refractory casing R; the carbon electrodes, C C′, at a 90° angle can be moved

DUCRETET ELECTRIC FURNACE.

forward and backward. The whole of the crucible is contained in the metallic frame, M M′; the back and front are closed by mica sheets, jointed with asbestos cardboard; the mica sheets may be removed and the reactions which take place inside can be observed by spectral analysis, and coloured glass slides can be interposed.

In presence of certain gases only, but not of the air, reactions take place in the closed chamber, C H. O O′, apertures for the circulation of gases; A B, terminals.

In the vertical form of furnace, a fixed carbon acts as lower electrode, and a movable carbon acts as the upper electrode. The drawback to this form is that if by any accident the operation is discontinued for a little time, the electrolyte solidifies, and it is therefore impossible to bring the upper carbon close to the lower one so as to strike the arc and re-start the operation. In the new electric furnace MM. Ducretet and Lejeune have avoided this drawback. They have also devised a very simple arrangement which increases the efficiency of the furnace to a remarkable extent. When the materials to be treated are introduced into the furnace through the opening, Bo, they pass between the carbons where the arc is formed and fall to the bottom of the crucible, C R, and are therefore only under the influence of the arc during the time they pass through it. MM. Ducretet and Lejeune place the apparatus between the poles of a horse-shoe magnet, which acts on the arc, making it many times longer and making it a real electric blow-pipe, which can be directed at will by varying the position of the magnet. With this apparatus, M. Joly, at the Ecolé Normale Supérieure, has been able to obtain metallic ruthenium.

## FREE WIRING.

BY ED. C. DE SEGUNDO.

THE New York *Electrical World*, of February 4th, contains an abstract of a paper on the above subject, read before the Canadian Electrical Association at Toronto by Mr. J. M. Campbell. This gentleman unconditionally condemns the free wiring system on the ground that an individual whose house has been wired free of cost by the supply company is not only perfectly independent of the company, but possesses an actual hold over them, in that he can always threaten to have the light cut off, and give the company notice to remove all the wiring and fittings. Mr. Campbell further points out that to post the cost of such wiring in the capital ledger of the company as an *asset*, is misleading and wrong. The wiring of a house is not like a diamond, which can always fetch a fair price in the open market. The difference between the cost of wiring a house for the electric light and the value of the wiring after it is put up is very great indeed, as it is obvious that the chief expense is the labour, and that a considerable amount of labour has to be again expended—if the wires have to be removed—in taking down the casing and making good the decorations. Moreover, the material thus obtained is not worth 50 per cent. of its original value, or anything like it, in the open market. Mr. Campbell suggests that the consumer pay for all the internal work from and including the main fuse; he then has an interest in the electric lighting of his house, and, if anything, the supply company has a hold over *him*.

There is, no doubt, much justification for Mr. Campbell's views, and we are not aware that any company of note in England have ever proposed to apply a portion of their capital to the wiring of the consumer's house, and then post up the full amount in their books as an asset. But what respectable company would conduct their business in this manner? It is true that most men have, at one time or another, had bitter experience of the peculiar notions prevailing in the States as to company management and finance; but it is difficult to conceive that so transparent a device as the one quoted by Mr. Campbell can be resorted to, to any extent, even in America.

Mr. Campbell writes from the company's standpoint, and urges that if his suggestion be universally acted on, the company will acquire a better class of business, and will have on their books a more responsible list of customers. True again. But the subject may be considered from many other points of view. There is no doubt that an electric supply company needs business, and as much of it as it can get, without resorting to methods which involve the outlay of a penny to secure a halfpenny's worth of business. Now as long as the electric light costs more than gas for an equivalent lighting effect, the large majority of people will prefer to put up with the disadvantages and discomforts and expenses attendant upon gas lighting rather than pay a larger bill for the electric light. It is therefore necessary for the electric supply company, which has to compete with so formidable an adversary as the gas supply company, to hold forth every possible commercially legitimate inducement to tenants of houses to use the electric light in the place of gas. There is further no doubt that the greatest bar to the extension of domestic electric lighting is the expense connected with the installation of the necessary wires. Not only is it a trouble and a nuisance to have workmen in the house (we are now speaking of the inconvenience to the vast majority who have no country residences), but it is impossible to show how the cost of the wires is to be retrieved. The fundamental condition necessary for the successful introduction of any new method is that the saving effected by its use over the old method will in such and such a time pay for the expense of the alteration, and the first cost of the apparatus, or will at least represent a substantial rate of interest on the amount laid out. Now, to bring home to the intending consumer the many sources of economy of electric lighting as compared with gas lighting, would require a great deal of patience on the part of the advocate of electric light, and a considerable amount of technical knowledge on the part of the consumer, which means that in 99 cases out of 100 the average member of the British public would come to the conclusion that an effort was being made to take advantage

of his ignorance on the subject. It is, therefore, of great importance to the prosperity of an electric supply company to do all they can to make it easy for the householder to have the electric light, and so acquire as quickly as possible the proper number of lamps proportionate to the money expended in mains, and there is little doubt that some system whereby the tenant is relieved of a portion, if not the whole, of the first cost of installation, would act as a wholesome stimulus to the electric lighting industry. It is certainly reasonable, and indeed only to be expected, that a tenant should object to lay out his own money for the improvement of a house which does not belong to him, and which he may leave at any time without being able to take his improvement with him, or even to obtain any consideration of any kind for it. The landlord's argument of course is, that *he* does not profit by it; why, therefore, should he pay for it? There is, however, a middle course. Whatever the landlord may *say*, it is obviously to his interest ultimately, that his property should be improved; and there is no doubt at all that a house in which gas pipes and electric light wires are run lets better than one with gas-piping only. Further, it is unreasonable on the part of the tenant, who has probably signed a lease for a certain term, to expect the landlord to do anything not provided for in the lease, or to go to any unnecessary expense during this term. It would appear that the following systems, or some modification of them, might be introduced with advantage: That the landlord agree to pay the cost of installing the wires, the tenant agreeing to pay an improved rent to cover depreciation and interest on the landlord's outlay, say, 15 per cent. per annum. That the tenant may exercise his option to bear the cost of installing the wires himself, or that the supply company apply part of their capital to this purpose, the tenant agreeing to pay a fair rent, and the landlord agreeing to pay interest at the rate of, say, 5 per cent. per annum on the company's outlay while the house is unoccupied, the landlord reserving to himself the right to take over the wiring from the supply company at a fair valuation at any time.

It is probable that up to the present the demand for the electric light has not been sufficiently great to call for such steps as have been suggested above, for, as long as the interest is one-sided, and as long as it takes two to make a bargain, it is not to be expected that such arrangements will be made. But electric lighting is steadily growing in favour, and quite recently one or two of our leading supply companies in London have effected a reduction amounting to 25 per cent. on the original charge for electricity for lighting purposes, and a greater reduction than this for motive power. This is a step in the right direction, and one or two similar steps will suffice to awake the landlord's interest in electric lighting, and to lead him on to practical measures.

## THE E.M.F. OF THE POST OFFICE STANDARD CELL.

[FROM A FOREIGN CORRESPONDENT.]

BY means of three perfect L. Clark's standard cells of absolutely equal E.M.F., we have determined the E.M.F. of some Daniell's cells of the Post Office pattern (commonly called the P.O. Standard Cell), and as the results thus obtained do not appear to be in accord with the generally accepted E.M.F. of this form of cell, we submit them to the readers of the REVIEW, hoping that they may prove of some interest and perhaps give rise to some further investigations of the subject.

The E.M.F. of the Clark's cells was in all cases taken as 1·454 B.A. volt, and all corrections for temperature were made in accordance with Lord Rayleigh's formula (see also Mr. Dearlove's investigations, the ELECTRICAL REVIEW, December 10th, 1886). Three P.O. cells were made up in the usual manner (the zinc amalgamated), but the purity of the chemicals and the density of the solutions were varied, so as to ascertain whether any perceptible change in the E.M.F. was caused thereby.

The following were the results (approximately):

With pure chemicals and semi-saturated solutions of sulphate of zinc:

1·12 B.A. volt.
1·13 „ „
1·13 „ „
1·13 „ „
1·13 „ „

With ordinary chemicals and same solution as above:

1·13 B.A volt.
1·14 „ „
1·13 „ „

With a fully saturated solution of sulphate of zinc:

1·12 B.A. volt.
1·116 „ „

With different kinds of zinc rods the following values were obtained:

Not amalgamated zinc:

1·06 to 1·075 B.A. volt (rather variable).

Not amalgamated zinc, but rod rubbed off with emery cloth:

1·11 B.A. volt.

With different copper plates the E.M.F. varied from 1·12 to 1·135 volt.

The E.M.F. did not alter perceptibly between 6° and 20° C., but the internal resistance of the cells varied between 8·5 and 9·5 ohms.

From this it would appear that the E.M.F. is reduced somewhat when a layer of oxide is formed on the zinc, and when the solution of the sulphate of zinc becomes saturated; but perhaps some one of your readers will inform us, how it is that the generally accepted figure is *1·07 B.A. volt* for these cells (*vide* Mr. Kempe's book on testing), a value considerably below our measurements.

## TREATMENT OF EXPENSES OF INSTALLING ELECTRIC WORKS.

[FROM OUR OWN CORRESPONDENT.]

As it has previously occurred in discussing the question of electricity in other cities, says Mr. Ave-Lallemant in a continental journal, the decision on the point of expense is confused for the lay public, and rendered so unnecessarily complicated that no clear idea can be formed concerning the standard to which comparative calculations should be referred. Cases have occurred in other cities in which such confusion seems to have been intentionally created, whence outsiders are easily led to conclude that this simplest and most important part of the question, that of cost, does not come within their comprehension.

We may, therefore, premise the following:—

If we seek to compare the cost of installing municipal electric works in different cities, we must by no means distribute the costs among the total number of glow lamps accidentally in connection (or their equivalent), but we must distribute these costs among that number of lamps (or their equivalent) which *can* burn simultaneously, for which, therefore, there is the needful capacity in the central. The proportion between those which can burn simultaneously, and those which are connected, varies greatly in different towns, depending more or less on local or otherwise accidental circumstances, whence it can never be determined beforehand.

Of course, in measuring the capability of the central we must deduct from its gross capacity the requisite reserve, so that even in the smaller centrals a complete set of machines, dynamos, and boilers, must be set aside as a reserve. An important part is also played by the capacity of the leads; the cables, which in the mean must be calculated as at least $1\frac{1}{2}$ times as great as the capability of the centrals.

I am about to refer everything to "a uniform glow lamp which can burn," or to 50 watts, which can be supplied simultaneously. If we adhere to this principle the matter will be intelligible to every outsider.

We first examine the question what data for Hamburg can

be ascertained for the installation and the cost of the works to be erected :

1. The electric works existing in the Post Strasse, with its accessories and cables.

According to the stipulation of the Finance Deputation of August, 1891, the installation without land and buildings, but including cables, is 1,300,000 marks. Ground and buildings are given as 500,000 marks, of which at least 250,000 marks must be reckoned for the building. Hence the total cost of the present continuous current installation equals 1,550,000 marks.

The capacity (also according to the stipulations above referred to), is 660,000 watts. From this at least 25 per cent. must be deducted as a reserve. The capacity, which is at any time available, is therefore at most 495,000 watts. This central station can therefore at the utmost, feed simultaneously 9,900 glow lamps (at 16 normal candles), or their equivalent. Hence the installation cost per glow lamp, when all are burning simultaneously, is about 152 marks.

2. In the above-mentioned stipulations there was prescribed to parties tendering, a general indication of the installation costs (besides the acquisition of the ground) for each capacity of 1,000 watts, that is, for every 20 glow lamps which can burn simultaneously. In the alternating current tender of October 7th, 1891, the installation costs were accordingly stated as equal at most to 1,500 marks for 1,000 watts capacity, that is, equals 75 marks for each glow lamp which can burn simultaneously. It was mentioned in addition, that for the extended cable network offered, the figure would probably come to 1,000 marks for each 1,000 watts connected, that is, 50 marks per glow lamp connected. It was therefore assumed that the maximum of the lamps which could burn simultaneously would be equal to two-thirds of the lamps connected.

In the report of the municipal committee this passage is in the original tender for an alternating current, *given falsely* —I cannot ascertain by whose fault. The lamps which are in connection and those which can burn simultaneously are directly interchanged. This deserves attention.

3. In the above-named report it is mentioned that according to the Schuckert project the expense (also without the purchase of land and without acquiring the existing installation) will be 8½ million marks for 150,000 to 160,000 total glow lamps "connected," accordingly as new installations have to be created for 140,000 to 150,000 lamps, about 1,200 marks for 1,000 watts. It is remarkable that the word "connected watt" is not expressly used, but calculation shows that this is meant :—

$$\frac{8{,}500{,}000 \times 1{,}000}{140{,}000 \text{ (to } 150{,}000) \times 50} = \text{about } 1{,}200 \text{ marks.}$$

Such a statement, however, does not, from the reasons stated above, aid us to an accurate direct comparison, but can at most give occasion for confusion and misunderstanding. If we calculate the same proportion between the lamps in connection and those which can burn simultaneously, as above in the alternating current tender, the installation cost per lamp burning simultaneously will be 90 marks.

4. In the municipal session of February 8th inst., Prof. Voller repeats that the firm offer of Schuckert calculates 11 million marks for 11,000 lamps, so that each lamp costs 100 marks. The word "firm offer" was probably an error, for so weighty, we might say the weightiest, consideration that the proposal is binding, is not mentioned with a single word either in the proposal of the Senate or in the report of the committee. This price was then compared by Prof. Voller with the figures resulting from the Frankfort opinion and for the prices at Frankfort per lamp burning simultaneously. Consequently Schuckert, whether firmly or not firmly, estimates the installation cost per lamp burning simultaneously (without the acquisition of the ground) at 100 marks.

We recapitulate the cost according to the above statements :—

| | | |
|---|---|---|
| 1. Existing installation ... | ... | 152 m. |
| 2. Alternating current, at most ... | ... | 75 „ |
| 3. Schuckert (report of committee) | ... | 90 „ |
| 4. Schuckert (according to Voller) | ... | 100 „ |

## SOME EXPERIMENTS WITH DISRUPTIVE DISCHARGES.*

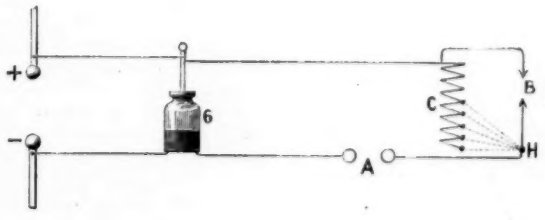
By ALEXANDER JAY WURTS.

A CIRCULAR recently sent to me, describing a new spark-gap arrester, containing a coil in the discharge circuit, makes the two following statements. First: "When a statical discharge takes place, and the line is struck, the lightning, of course, seeks the most direct outlet to earth, and that is through the arrester, for the resistance of this whole apparatus from line binding post to ground is less than one-sixth ($\frac{1}{6}$) of an ohm." The second statement is: "It might be thought that this coil offers some resistance to the passage of the lightning, but it does not offer any more than a straight conductor of the same cross section and length, for the core, or armature, is not inside the winding until after the passage of the lightning. There is no self-induction in this arrester, as some might suppose, for there is no current flowing through the coil until after the passage of the lightning, and the passage of the lightning is instantaneous, and it cannot produce induction to hinder its own passage." This arrester is also described in the *Electrical Engineer* (New York) for December 14th, 1892.

The first of these two statements, in speaking of the ohmic resistance from line to ground being less than one-sixth of an ohm, can hardly be correct, for if even the smallest spark-gap were included, the resistance would then be practically infinite. If, however, it is only the resistance of the coil that is considered, then, either the wire of which the coil is made must be very fine (assuming that it is made of copper), or if it were even as large as No. 7, its length would be considerable, for the resistance of 1,000 feet of No. 7 copper wire is ·150 of an ohm. If this coil is four (4) inches in diameter, and contains 1,000 feet of wire, it would then consist of about 1,000 turns. I will presently describe some interesting experiments that I have made, and the reader will then judge for himself whether this arrester offers any considerable resistance to the passage of disruptive discharges such as occur during thunderstorms across the spark-gap of an arrester when connected to overhead wires.

The second statement is well covered in Mr. Wm. Turbayne's article, published in *The Electrical Engineer* for December 28th, 1892. Mr. Turbayne has, however, made statements without giving the practical illustrations which are so necessary in order to carry conviction to the vast majority of men particularly interested in this subject, and who, although fairly well posted in the fundamental principles of electricity, are wholly ignorant of the more intricate problems, seldom studied outside the laboratory. The experiments which I am about to describe are intended to illustrate facts in a simple, comprehensive manner, and without the technicalities and formulæ which so often accompany matter of this kind and draw but a passing glance from the "practical man."

The apparatus and connections used are clearly shown in the accompanying figure, in which "+" and "−" represent




the two terminals of a Toepler-Holtz influence machine. "6" is a battery of six one-half gallon Leyden jars. A is a $\frac{1}{32}$ inch spark-gap between two brass ball electrodes, each $\frac{1}{2}$ inch in diameter. C is a coil of wire, the material and dimensions of which are changed according to circumstances. The specifications for this coil will be given for each test. B is a spark-gap, which may be adjusted at pleasure. It is

* New York *Electrical Engineer*.

connected in shunt to coil, C, and consists of blunt points made from ½ inch brass rod.

The object of the influence machine, "+" and "—," is to statically charge the battery of jars, "6". The object of the jars is to accumulate a sufficient quantity of static electricity to produce a violent disruptive discharge. The object of the spark-gap, A, is to cause a disruptive discharge to take place through the coil, C, or across the gap, B, as the case may be. The object of the gap, B, is to determine the relative resistance offered by the coil, C, to a given disruptive discharge, by adjusting the distance between the confronting points till the discharge shall just leap the gap, in preference to passing through the coil. The object of changing the dimensions and material of coil, C, will be understood as we proceed. The object of each test is to determine the length of spark-gap at B, that a disruptive discharge, such as would occur at A, will rather leap than pass through a coil placed at C. In other words, the length of the spark-gap, B, as given in the following table, is a comparative measure of the resistance offered by the coil to the disruptive discharge.

The first coil placed at C was made of No. 14 German silver wire. It was $\frac{9}{16}$ths inch in diameter, and contained no core. The number of turns included by the circuit, B, was varied by connecting the point, H, to different points in the coil. The following are the results obtained: The numbers under column "C" indicate the number of turns used in coil, C; the numbers under columns "B (1)" and "B (2)" indicate the number of thirty-seconds of an inch that the disruptive discharge would prefer to jump rather than pass through the specified number of turns in coil, C. From the connections indicated, it will be evident that the discharge will have a choice between the path, C, and the path, B.

| C | B (1). German silver. | B (2). Copper. |
|---|---|---|
| 82 | 11· | 14· |
| 77 | 10·75 | 13·5 |
| 72 | 10·50 | 13· |
| 67 | 10·25 | 12·5 |
| 62 | 9·75 | 11·75 |
| 57 | 9·50 | 11·25 |
| 52 | 9·25 | 10·75 |
| 47 | 8·75 | 10·25 |
| 42 | 8·25 | 9·75 |
| 37 | 7·75 | 9· |
| 32 | 6·75 | 8· |
| 27 | 6·25 | 7·25 |
| 22 | 5·25 | 6·25 |
| 17 | 4·25 | 5· |
| 12 | 3·25 | 3·25 |
| 7 | 1·50 | 1·75 |
| 2 | ·50 | ·50 |

Thus it will be noticed that the disruptive discharge, rather than pass through 82 turns of this German silver wire coil containing no core, will jump about ⅓rd of an inch. This coil being made of German silver had a high ohmic resistance compared with a similar coil made of copper. But this resistance plays no appreciable part in impeding the passage of the discharge, as will be seen from the following.

The next test was made with a copper coil of the same sized wire as the German silver, and was supposed to have the same dimensions; as a matter of fact, however, it was a shade larger in diameter. The results obtained with the copper coil are given in column "B (2)."

It will thus be seen that the copper coil, in spite of its low ohmic resistance, offered even a higher resistance to the passage of the discharge than did the German silver coil. But this increased resistance is no doubt partly due to the slightly increased diameter of the copper coil over that of the German silver coil; for the greater the diameter of a coil the greater will be the resistance offered to the passage of a disruptive discharge. To demonstrate this fact, I connected at C a coil 8 inches in diameter, consisting of 19 turns of No. 4 copper wire, and found the "B" spark to be 21.

Not having the dimensions of the coil in the above-mentioned arrester, I am unable to give the comparative resistance that this arrester will offer to the passage of a disruptive discharge. Assuming, however, that the coil is 2 inches in diameter and contains only 100 turns, it will be evident from the above figures that the arrester will offer a very difficult path to the passage of disruptive discharges. In view of this fact the possibility of fine adjustment in the spark gap, also claimed for the arrester, amounts to nothing at all.

Now an increase in the length of the spark gap at A will cause the battery of jars to discharge at a greater difference of potential; the amount of charge will be greater, and consequently that of the discharge. With every increase in the intensity of the discharge at A, there is considerable increase in the "B" value for any given coil, C. It is, therefore, fair to assume that the "B" values found in these experiments will be considerably larger when the conditions are such as are usually experienced during thunderstorms.

Having thus far illustrated facts, it will now be proper to explain that a disruptive discharge is oscillatory in its character; that is, it is similar to an alternating current of very high frequency, and it consequently meets with self-induction in its passage through wires. The frequency developed in a disruptive discharge is, however, vastly greater than that developed by an alternating current dynamo, and the inductive resistance being proportional to the frequency, is also enormously greater; this fact, therefore, accounts for the high resistance offered to discharges of this kind by even a few turns of large copper wire.

The inventor of the above-mentioned arrester is also mistaken in his assumption that the coil of the arrester offers less resistance when the iron core is out than when it is in, for the oscillations of the discharge are too rapid to affect the iron. Consequently, there is no increase in the self-induction when the iron is in, or, if there is, the effect is so insignificant that it is more than compensated for in the Foucault currents set up in the core. These Foucault currents will, of course, act as a closed secondary and tend to reduce the inductive resistance of the coil. In fact, with the above-mentioned copper coil made of No. 4 wire, and with which "B" was found to have a value 21, the introduction of a bundle of iron wires into the interior of the coil caused the resistance to decrease and gave a "B" spark equal to 17.

In order to demonstrate that there was no perceptible magnetic action due to the presence of the iron core, in other words, that the same results would be obtained with a non-magnetic metal, I coated the inside of the coil with tin foil, and on again measuring "B" found it to be 17, as before. The tin foil formed a secondary to the coil, and therefore reduced its inductive resistance. If the ends of the tin foil coating made poor contact, a brilliant spark would appear at that point each time a discharge passed through the coil, and a hole was burned in the foil. The Foucault currents in the bundle of iron wires manifested themselves by a beautiful display of scintillating sparks between the wires of which the bundle was made. Upon repeatedly passing the discharge through the coil, however, the scintillating sparks gradually decreased, but at once reappeared when the iron wires were connected to earth. A slight shock was felt on touching them with the hand. There is thus static as well as dynamic induction between the coil and its metal core.

It is curious to note that the coil described in connection with the above-mentioned arrester as offering no resistance to the passage of the discharge forms one of the principal features in the "Tank Arrester" (see the *Electrical Engineer*, November 16th, 1892), for preventing disruptive discharges from reaching the generator; in fact, such a device is commonly called a "choke coil."

In a subsequent article I shall continue these practical illustrations, showing the impedance offered by comparatively straight wires; the necessity for using a large number of line arresters, in order to form an efficient protection for electric circuits; also the best means and materials for making lightning arrester connections to earth.

## REVIEW.

*Polyphased Alternating Currents.* By E. HOSPITALIER. London:—Alabaster, Gatehouse & Co.

This work is a reprint of an excellent series of articles which appeared in the ELECTRICAL REVIEW, of London.

Without going into minute detail regarding the polyphase

motors and generators, the work gives a very good idea of the whole matter, and would prove a first-class text-book for electrical engineering students getting up this subject.

The Frankfort Exhibition first exhibited to the public what could be done by polyphased currents. Those who had not the advantages of inspecting the machines at the exhibition can find in this little work very clear and simple descriptions, and explanations sufficient to enable anyone conversant with simple alternating currents to grasp the theory and practice of polyphased alternating currents as they existed at the date of the exhibition. The subject has never been pursued with so much interest in Britain as it has been in Germany, but it is a topic which no electrical engineer can afford to pass over. Like most new departures it will probably take a few years' time to fully realise what the discovery and applications of polyphased currents may lead to; already we know of several applications of some of the principles to simple alternating current working which promise to considerably revolutionise electrical distribution.

Perhaps the most interesting chapter in the book is Chapter IV. "Multiple Transformers," and the same subject on page 67 (why is this not in a chapter). This the work treats of very clearly and simply, but since the articles were written a very considerable amount of work has been done with "multiple transformers," and very important improvements made which might have been noticed and described in the book.

The book is beautifully printed on good paper, and although a little late in coming out, will be of value to everyone interested in the progress of electrical distribution.

R. K.

## THE ELECTRIC LIGHTING OF BELFAST.

PROF. ALEXANDER B. W. KENNEDY, F.R.S., has just furnished the Belfast City Council with an elaborate report regarding the proposed electric lighting of the city. After mentioning that he has carefully examined the streets and buildings, and inspected several possible sites for a central lighting station, he states that he has been compelled to make his own estimate as to the probable demand for electric light in the city, based upon observation and his experience in other places. Within two or three years of the starting of the works the corporation may have to supply current to the equivalent of about 8,500 lamps of 8-candle-power each, wired in what he calls the "Central District," while in the "Southern District"—the Plains, Botanic Gardens, and Lisburn Road neighbourhood—which is treated separately, there may be 4,000 lamps of 8-C.P. required. In the one case it would be amply sufficient to provide for 6,100 lamps alight at the same time, and in the other for about 1,400 such lamps. Each 8 C.P. lamp in the Central District will use about 17·5 units per annum, and in the Southern District about 11·5 units. If the rate of charge be 6d. per unit, the income per lamp would be 8s. 9d. and 5s. 9d., and the total income £3,850 and £1,200 respectively per year. The maximum rate at which electrical energy would have to be delivered to consumers would be about 200 kilowatts and 45 kilowatts respectively, these being the figures which govern in connection with each particular system of generating plant, the dimensions of the engines and dynamos. Prof. Kennedy has no difficulty in dealing with the central district which includes all the first-class shops, clubs, banks, and business concerns, but outside this there is a ring having a breadth of three-quarters of a mile covering the industrial part of the city, and he does not think there would be much demand for electric light there unless the work could be carried out on such a large scale as to reduce its price very much below anything at present possible. To put the electric and gas supplies on something approaching equal terms would require the expenditure of 10 times the capital estimated for, and no electric light scheme short of a great one such as this would serve to sensibly relieve the pressure on the existing Gas Works. Beyond the "industrial ring" are the residential districts, northern and southern, and while the Professor only deals directly with the southern he says the system best adapted for it can be applied later on in the northern, as the conditions are almost identical. The southern district could be most cheaply supplied with electric energy by a high tension alternating current system with a separate transformer on the premises of each consumer. Unfortunately there does not exist (except on paper) any satisfactory means of cutting these transformers out of circuit when they are not in use. The effect on the economy of the station of leaving them always on circuit is so considerable that Prof. Kennedy recommends the Corporation to expend an additional £1,500, the extra cost of laying low tension distributing mains, which is undoubtedly the best system for the central district. Of the available sites for a central station either one in Ormean Avenue, or one at the River Lagan immediately below the Albert Bridge would serve perfectly for generating high pressure current, but the riverside would be out of the question for a low pressure system. The Professor, however, works out a scheme entirely different from that in vogue in any part of England or Scotland. The object of this is that the Corporation may gain the economy involved in the use of batteries at a cost very much less than that of a direct three-wire system from one central station in the usual way. This could be achieved by means of sub-stations containing continuous current transformers on the Oxford system; but after the most complete consideration Prof. Kennedy believes the most economical and advantageous form of sub-station for Belfast is one in which the dynamos are driven by ordinary gas engines, using town gas which costs 2s. 3d. per 1,000 cubic feet. The central sub-station would be the head-quarters of the system of distribution containing two gas engines each of about 50 indicated horse-power, with corresponding dynamos and would contain also a battery of moderate output (say about 500 ampère-hours capacity), besides all the principal regulating apparatus and instruments, and would be always at work when it would be necessary for any machines to be running at all. The central station would not always be at work, although the use of gas engines would allow its machinery to be started at any moment if required. Even in winter it would only be necessary to have it open for one watch per day. It would contain the plant for taking up three-fourths of the load, together with all reserve plant, which would occupy more space than could be found conveniently in the centre of the city. If the demand for electric light varied in the same proportion as the gas, it would be unnecessary to run the central station at all during three or four months in the year. A basement space having an area of about 750 or 800 square feet (or less if direct driving engines could be obtained), situated in the centre of the city, would entirely serve the purposes of the sub-station. The Professor discusses the merits of ordinary coal *versus* generator gas, in favour of the former and shows how the Southern district of the city could be worked by two sub-stations connected with the central station. He estimates the total cost of the scheme recommended, exclusive of land, buildings and meters, but inclusive of the whole of the plant and machinery, mains and road work, at about £19,000 for the central district and at about £11,000 for the Southern. The latter includes about 10,200 yards of road work, nearly double the amount in the central district. The actual station expenses, including salaries, wages, gas, stores, and repairs, when 8,000 lamps would be wired, should be about 3d. per unit sold. Expenses of management, rent, rates and taxes, interest and sinking fund, and a necessary and proper allowance for depreciation, would add 3d. per unit more to the cost. Prof. Kennedy, therefore, thinks it not unreasonable that the corporation should start the electric supply with a charge of 7d. per unit, but adds, that as so large a proportion of the total costs are practically fixed charges—salaries, wages, rates and rent, interest and depreciation—the very best way to reduce the cost per unit is to increase the number of units sold. From this point of view, the corporation would, no doubt, consider very seriously whether it would not be the wiser policy to start with a charge of 6d. per unit at once, in order to raise the output as speedily as possible. These are the main features of Prof. Kennedy's exhaustive report, which is under the consideration of the gas committee of the Belfast Corporation.

## NEW PATENTS—1893.

3,690. "A combined ammeter and voltmeter." W. R. MORRIS. Dated February 20th.

3,720. "'Sourdine' for induction coils." G. ANDREOLI. Dated February 20th.

3,729. "Improvements in the supply of electric current for electric railway, tramway, and other purposes." G. KAPP. Dated February 20th.

3,734. "Improvements in secondary battery plates or elements." A. HOUGH and O. MARCH. Dated February 20th.

3,743. "Improvements in the preparation of carbon electrodes for electrolytic operations." E. H. LIVEING. Dated February 20th.

3,744. "Improvements in the construction of carbon electrodes." E. H. LIVEING. Dated February 20th.

3,747. "Improved process for the production of electrolytic copper." M. PERREUR-LLOYD. Dated February 20th. (*Complete.*)

3,757. "Improvements in thermo-dynamic motors." A. C. BROWN. Dated February 21st.

3,779. "A new or improved carbon holder for arc lamps." W. STORR. Dated February 21st.

3,804. "Improvements in electro-photography. J. WARING. Dated February 21st.

3,817. "Improvements in armature cores." A. W. SMITH. Dated February 21st.

3,823. "Improvements in electro-magnetic motors." P. E. MOUROT. Dated February 21st.

3,831. "Improvements in telephone exchange systems." J. E. KINGSBURY. (Communicated by the Western Electric Company, United States.) Dated February 21st.

3,833. "Improvements in electric connections." E. W. LLOYD. Dated February 21st.

3,883. "Improvements in and relating to the distribution of electrical energy." W. LOWRIE. Dated February 22nd.

3,953. "Improvements in the construction of field magnets for dynamo-electric machines." E. T. HUGHES. (Communicated by C. F. Daniels, United States.) Dated February 22nd.

3,966. "Improvements in and relating to the distribution of electrical energy." W. LOWRIE. Dated February 23rd.

3,979. "Improvements in telegraphic receiving instruments." J. F. HOFFGAARD. Dated February 23rd.

3,980. "Improvements in telegraphic receiving instruments." J. F. HOFFGAARD. Dated February 23rd.

4,024. "Improvements in storage batteries or accumulators." W. P. THOMPSON. (Communicated by the firm of A. Vogel, Germany.) Dated February 23rd.

4,036. "An improved means of taking power from electro-motors." C. R. GARRARD and T. W. BLUMFIELD. Dated February 23rd.

4,040. "Improvements in type-writing telegraph instruments." W. LANGDON-DAVIES. Dated February 23rd.

4,077. "Improvements in the construction of electrical measuring instruments." H. C. L. HOLDEN. Dated February 24th.

4,086. "Improvements in and relating to electrical switches, partly applicable to other electrical appliances." J. H. WARD and M. H. GOLDSTONE. Dated February 24th.

4,087. "Improvements in and relating to terminals for electrical purposes." J. H. WARD and M. H. GOLDSTONE. Dated February 24th.

4,091. "Improvements in electrical measuring and other instruments." F. H. NALDER, H. NALDER, C. W. S. CRAWLEY, and A. SOAMES. Dated February 24th.

4,096. "Improvements in dynamo-electric generators, motors, and motor-generators." R. KENNEDY. Dated February 24th.

4,103. "Improvements in and relating to dynamo-electric machines." W. LOWRIE. Dated February 24th.

4,106. "A process for maintaining positive plates of secondary voltaic batteries in good operative condition." L. EPSTEIN. Dated February 24th.

4,111. "Improvements in means or apparatus for establishing telegraphic communication with trains." F. W. GOLBY. (Communicated by N. J. B. Etienne, France.) Dated February 24th.

4,144. "An improvement in the electrodes of electric, galvanic, and other batteries." A. W. ARMSTRONG. Dated February 24th.

## ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1891.

*The Price of all Specifications (old and new) is now 8d. each.*

8,696. "Improvements in microphones." C. HUELSER. Dated May 21st. Essentially consists in lifting the carbon cylinders, surrounded by an iron casing, by means of an adjustable magnet support without touching the cylinders, thereby preventing the carbon dust from "packing," allowing of a free vibration of the diaphragm and producing a more uniform action of the apparatus. 1 claim.

8,806. "Improvements in dynamo-electric and electro-dynamic machines." A. I. GRAVIER. Dated May 23rd. A bipolar machine constructed according to the invention comprises two electro-magnets arranged in the same plane; the armature being between them. On each side of the pole of each electro-magnet, a supplementary pole is placed; the supplementary poles pertaining to each electro magnet being of opposite sign to that of the central pole. These supplementary poles are used instead of the ordinary enlarged pole-pieces, and they should be placed close against the central pole. They may be wound with wire, but it is not essential for them to be so wound. There are four brushes arranged radially; these brushes being directed toward points between the central poles of the electro-magnets and the supplementary poles thereof. 3 claims.

10,894. "Electrometers." C. V. BOYS. Dated June 26th. The inventor makes the needle out of an even number of sectors which nearly complete the form, preferably of a disc or a cylinder. Alternate arms are kept oppositely electrified by contact with the ends of a dry pile forming part of the needle, or by connecting one set to one terminal of a Leyden jar or a battery or other charged body and the other set to the other terminal of the jar, battery or other charged body as the case may be. The two sets of arms may be conveniently connected to the above, one by a torsion wire, spring or metallically coated fibre and the other by a similar connection or by wire dipping in a conducting fluid in the usual way. 4 claims.

11,560. "Improvements in and relating to galvanic batteries." G. G. M. HARDINGHAM. (A communication from abroad from J. R. Hard and H. Connett, both of New York.) Dated July 7th. One form of galvanic cell, to which this invention is especially applicable, consists of a deep, tubular, zinc cup, forming the positive element, in which is placed a rod or piece of chloride of silver, forming the negative element. This latter element is surrounded by an excitant of a gelatinous nature. The zinc cup forms one contact or pole, and a silver wire, embedded in the negative element, and projecting from the cup, forms the other pole. 8 claims.

12,018. "Improvements in electrical gear for steering ships and controlling the movement of holophotes, guns, and the like." E. WILSON. Dated July 15th. The inventor employs one or more switches, which are in connection with a voltmeter or electro-dynamometer, in such a manner, that by varying the position of the switch handle he varies the intensity of the current in the coils of the said voltmeter or electro-dynamometer. The said voltmeter or electro-dynamometer controls a reversing switch, which reverses the current in a motor, which actuates through suitable gearing the rudder, holophote, or other apparatus to be controlled. 5 claims.

12,384. "Improved compound for insulating electric wires in general." M. MACKAY. Dated July 21st. Consists of a compound of 4 lbs. kaurie dust, or the solid gum; 2 lbs. castor oil; 2 lbs. Stockholm tar; 1 lb. gutta-percha; 4 lbs. ground asbestos. 1 claim.

12,484. "Improvements in telephonic switching apparatus." A. R. BENNETT. Dated July 23rd. The object of the invention is, in a telephone exchange, operated by metallic circuits and multiple switchboards constructed conformably to specification No. 19,486 of November 29th, 1890, to provide a method by means of which the operator at any one section of such a multiple switchboard can, by applying a test, discover whether any particular subscriber's metallic circuit is connected at any other section. 4 claims.

12,529. "Improvements in means for distributing electric currents." H. EDMUNDS. Dated July 23rd. The inventor connects the several mains (whether simple or compound) by which the supply of the current is conducted to the several places of utilisation with a number of generators of current in such a manner that the adjacent mains form the positive and negative conductors to the respective generators, the mains other than the outermost ones constituting the negative and positive conductors from and to the corresponding generators. 2 claims.

12,605. "Improved means for securing terminals or binding screws to plates or electrodes for electric batteries." H. H. LAKE. (Communicated from abroad by Lacombe & Co., of Levallois-Perret, near Paris.) Dated July 24th. The plate or electrode is, according to the present invention, made with a transverse hole or cavity therein to receive a nut, and with another hole extending longitudinally from its upper surface to the said hole or cavity for the nut. These holes are preferably formed in an enlargement or head at the upper end of the carbon. Through the said longitudinal hole is passed the screw-threaded stem of the terminal or binding screw, and upon this stem is screwed the aforesaid nut. A lock-nut or back-nut is also provided upon the said screw-threaded stem, and is adapted to be screwed tightly against the upper surface of the head or enlargemont of the plate or electrode, to secure the terminal or binding screw firmly thereto. 2 claims.

12,726. "Improvements in the construction of armatures for certain kinds of electrical machines." W. P. THOMPSON. (A communication from abroad by W. Labmeyer & Co., of Frankfort-on-the-Maine.) Dated July 27th. Relates to a method of constructing the armature of a transformer in such a way that, between the high and low tension coil, metal is employed, which may be connected with the earth, and which does not serve as a current conductor. 2 claims.

16,451. "Improved system of electric train signalling for preventing railway collisions." W. P. THOMPSON. (A communication from abroad by E. Espiau and P. Ferrer, both of Barcelona.) Dated September 28th. Consists in providing a means by which the driver of a train shall be in constant communication with the next station or even with the train which is travelling on the same set of rails in an opposite or in the same direction as the first one, thus allowing of its course being arrested in time, thanks to suitable signals, to prevent a collision which would otherwise take place. 3 claims.

16,931. "Improvements in electric meters." E. C. GRASSOT. Dated April 4th. (Under International Convention.) When the current flows through the apparatus, metal is dissolved from a vertical wire anode, the lower end of the wire resting on a glass block. The wire anode remains pointed, and, as it diminishes in length, descends at a rate proportional to the intensity of the current passing. 4 claims.

18,097. "Improvements in galvanic batteries." C. N. SOUTHER. (Under International Convention.) Dated March 23rd. Relates to galvanic batteries, which are designed principally to be used on closed circuit work. The object of the invention is to produce a cell of strong and uniform current, and which may be cheaply constructed and maintained.

## CORRESPONDENCE.

### Ozone in Agriculture.

Your article on the applications of ozone, its use in agriculture and horticulture for the destruction of the lower forms of life, animal and vegetable is important. Dr. Fröhlich finds that it kills all insects but one, probably the cockroach. It may fairly be asked how many of the existing species—probably little short of a million—he has experimented upon. If many of these species, locusts, mosquitoes, leaf-cutting ants, &c., are fearfully injurious, many others are decidedly beneficial, so that their destruction, if practicable, would be a misfortune.

The same difficulty occurs with microbia. It would be highly desirable to extirpate the germs of cholera, malaria, and yellow fever. But if at the same time we destroyed the bacteria which transform the nitrogen of defunct animals and plants into nitric acid and ammonia, and which enable the roots of leguminous plants to utilise the nitrogen of the air, we should go far to smite the earth with barrenness. Nor would the expulsion of earth-worms be at all advisable. The expense of saturating the soil of a vineyard with ozone, for the purpose of exterminating the phylloxera, which, by the way, is not a microbe but an insect, might be prohibitive. The question is of sufficient importance to deserve the study of entomologists and bacteriologists.

**J. W. Slater.**